केंखाजपाअसं
CIBA

ANNUAL REPORT 2025

भा.कृ.अनु.प. - केंद्रीय खारा जलजीव पालन अनुसंधान संस्थान

ICAR-CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE

Cover page

Super intensive precision and natural shrimp farming (SIPNSF)
An indigenous climate-smart innovation integrating precision engineering, practical automation, and nature-based processes for sustainable shrimp farming

ANNUAL REPORT
2025

केंखा ज पा अ सं
CIBA

भा कृ अनु प - केंद्रीय खारा जलजीव पालन अनुसंधान संस्थान
(भारतीय कृषि अनुसंधान परिषद)

75, संथोम हाई रोड, एम आर सी नगर, आर ए पुरम
चेन्नई 600028, तमिल नाडु, भारत

ICAR - CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
ISO 9001 : 2015
(Indian Council of Agricultural Research)
75, Santhome High Road, MRC Nagar, RA Puram
Chennai - 600028, Tamil Nadu, India

Published by

Dr. Kuldeep K. Lal
Director

Hindi Translation :
Shri Navin Kumar Jha
Dr. Sujeet Kumar

ISSN 0976-5336 © Central Institute of Brackishwater Aquaculture 2025

Citation:
ICAR - CIBA, 2025. Annual Report 2025. Central Institute of Brackishwater Aquaculture, Chennai. 244 pp.

Layout, Design & Printing:
Aparna Graphic Arts, Chennai


Contents


गृह मंत्रालय
Ministry of Home Affairs

Preface

ICAR–Central Institute of Brackishwater Aquaculture (ICAR-CIBA) has continued its focused efforts toward advancing science-driven, sustainable, and climate-resilient brackishwater aquaculture in the country. The Institute remains committed to developing innovative technologies and strategic interventions that address the emerging challenges of the aquaculture sector while enhancing farmers' incomes, generating employment opportunities, and strengthening nutritional security.

The brackishwater aquaculture sector continues to be a major contributor to India's seafood exports and blue economy. Shrimp remains the most important blue food commodity, contributing the highest share in export value and serving as a key driver of India's seafood export sector. However, the industry is currently confronted with several challenges, including disease outbreaks, rising input costs, environmental concerns, climate variability, declining broodstock quality, market fluctuations, and the need for sustainable intensification. Furthermore, issues related to maturation and spawning efficiency, larval quality, emerging diseases, productivity losses, and overdependence on non-native species necessitate long-term scientific solutions and ecosystem-based management approaches.

Recognising these challenges, ICAR-CIBA has strengthened its research efforts in the selective breeding of indigenous species, diversification of farming systems, development of low-input and eco-friendly technologies, aquatic animal health management, precision farming, climate-smart aquaculture, and digital interventions for real-time farm advisory services. The Institute is actively promoting species diversification through the culture of Indian white shrimp, Asian seabass, mud crab, milkfish, pearlspot, and seaweed-integrated farming systems to enhance the sustainability and resilience of the sector.

During 2025, significant progress was achieved in areas such as super-intensive precision shrimp farming systems, indigenous shrimp breeding programmes, improved feeds and aquatic animal health products, hatchery technologies, biosecurity measures, inland saline aquaculture, and environmentally sustainable farming models. The Institute also continued its efforts in technology dissemination, stakeholder capacity building, policy support, and strengthening collaborations with national and international organisations.

This Annual Report presents the major achievements, research highlights, developmental activities, and institutional progress made by ICAR-CIBA during the year. The report reflects the dedication and collective efforts of the Institute's scientists, technical and administrative staff, farmers, industry stakeholders, and collaborating agencies in advancing sustainable brackishwater aquaculture in India.

I express my sincere gratitude to the Hon'ble Secretary, DARE and Director General, ICAR; the Deputy Director General (Fisheries Science), ICAR; and all officials of ICAR for their continuous guidance and support. I also place on record my appreciation to the scientists, staff members, farmers, entrepreneurs, industry partners, and collaborating institutions for their valuable cooperation and contributions.

I hope that the technologies, initiatives and achievements documented in this report will further strengthen the vision of sustainable, economically viable and socially inclusive brackishwater aquaculture in the country.

(Dr. Kuldeep K. Lal)
Director, ICAR - CIBA

कार्यकारी सारांश

उच्च घनत्व वाले HDPE अस्तर लगे तालाबों में पैसिफिक सफेद झींगों का उत्पादन

पीनियस वन्नामेय झींगों के बीजों/बच्चों (0.24 ग्राम वजन वाले) को HDPE जियोमेम्ब्रेन–लाइन वाले तालाबों में 134 और 117 झींगे/वर्गमीटर घनत्व पर संग्रहीत किया गया। इससे 1.89 और 2.20 कि.ग्रा./वर्गमीटर की उत्पादकता प्राप्त हुई, जो क्रमशः 18.93 और 22.0 टन प्रति हेक्टेयर प्रति फसल के बराबर है; यह इस प्रणाली की उच्च उत्पादन क्षमता को दर्शाता है।

इनडोर टैंक प्रणाली में पैसिफिक सफेद झींगों का नर्सरी संवर्धन

नवसारी, गुजरात में 50 टन टैंक वाली प्रणाली में पैसिफिक सफेद झींगे (पीनियस वन्नामेय) के दो इनडोर नर्सरी ट्रायल किए गए। पोस्ट–लार्वा (2,500 प्रति घटमीटर की दर से संग्रहीत) ने 32 दिन के बाद उच्च उत्तरजीविता दर (87–100 प्रतिशत) और 0.045 का औसत वजन प्राप्त किया। क्षेत्र में WSSV के प्रकोप के दौरान 50 दिनों तक के संवर्धन से 0.25 ग्राम के जुवेनाइल (छोटे झींगे) प्राप्त हुए, जिनकी उत्तरजीविता दर 58–72 प्रतिशत रही। सही तरीके से आहार देने, समय पर जल विनिमय और कार्बन आधारित अमोनिया मैनेजमेंट से नर्सरी की स्थितियां अच्छी रहीं और इस प्रणाली से स्वस्थ नर्सरी पालन वाले झींगे के बीज तैयार करने की क्षमता का पता चला।

SIPNSF प्रणाली मे पालित पैसिफिक सफेद झींगों में संग्रहण घनत्व का गट माइक्रोबायोटा डायनामिक्स पर प्रभाव

SIPNSF से स्वच्छ जल में स्थानांतरित किए गए *पीनियस वन्नामेय* की आंत सूक्ष्मजीवों की गतिशीलता ने संग्रहण घनत्व के महत्वपूर्ण प्रभावों को प्रकट किया। उच्च–घनत्व पालन (300 झींगा प्रति वर्ग मीटर) के परिणामस्वरूप उच्च माइक्रोबियल टर्नओवर, उच्च विविधता फैलाव और विब्रियो बहुतायत में वृद्धि हुई, जो कम स्थिरता और डिस्बिओसिस जोखिम का संकेत देता है। कम घनत्व वाले झींगों (190 झींगा प्रति वर्ग मीटर) ने अधिक स्थिर और सुसंगत माइक्रोबियल समुदाय पुनर्गठन बनाए रखा।

बायोफ्लॉक आधारित अति–सघन पालन प्रणाली में भारतीय सफेद झींगों और पैसिफिक सफेद झींगों के प्रदर्शन की तुलना

पीनियस वन्नामेय और *पीनियस इंडिकस* के साथ 90 दिनों के बायोफ्लॉक कल्चर अध्ययन से पता चला कि CIBAFLOCK और पेरीफाइटिक सब्सट्रेट (BFT3) वाले एकीकृत प्रणाली में सबसे अधिक वृद्धि हुई, जिसमें क्रमशः 19.56 ग्राम और 18.76 ग्राम का अंतिम वजन प्राप्त हुआ। बेहतर पाचन, मेटाबोलिक, एंटीऑक्सीडेंट और इम्यून रिस्पॉन्स ने टिकाऊ झींगा उत्पादन के लिए इस प्रणाली की क्षमता को उजागर किया।

प्राकृतिक चारे पर आधारित परिशुद्ध (प्रिसिजन) सघन पालन प्रणाली में अलग–अलग संग्रहण घनत्वों पर टाइगर झींगों का प्रदर्शन

पीनियस मोनोडॉन के साथ सेमी–फ्लॉक स्थितियों में 142 दिनों के 'ग्रो–आउट' पालन से पता चला कि कम संग्रहण घनत्व (30 झींगे प्रति घनमीटर) में बेहतर वृद्धि (38.4 ग्राम), उत्तरजीविता (98 प्रतिशत) और आहार दक्षता (FCR 1.58) हासिल हुई। अधिक घनत्व (100 झींगे प्रति घनमीटर) में बायोमास का उत्पादन सबसे अधिक (788.9 किलोग्राम) हुआ, जो टिकाऊ झींगा पालन के लिए व्यक्तिग परफॉर्मेंस और कुल उपज के बीज के संतुलन को दिखाता है।

बायोफ्लॉक प्रणाली में किण्वित सूक्ष्मजीवी संघ के प्रभाव का अध्ययन

पैंतालीस दिनों के आहारीय परीक्षण से पता चला कि माइक्रोबियल कंसोर्टियम किण्वित बायोफ्लॉक ने *पीनियस वन्नामेय* की वृद्धि, उत्तरजीविता, प्रतिरक्षा और पाचन जीन अभिव्यक्ति में काफी वृद्धि की है। किण्वित बायोफ्लॉक उपचार में झींगों ने उच्चतम वजन वृद्धि (9.70 ग्राम) और उत्तरजीविता दर (97.2 प्रतिशत) प्राप्त की, जो झींगा स्वास्थ्य और उत्पादन प्रदर्शन में सुधार के लिए एक प्रभावी रणनीति के रूप में इसकी क्षमता को दर्शाता है।

आसान अवशोषण वाले खनिजों के उपयोग से आयरन और सेलेनियम में समृद्ध बायोफ्लॉक का उत्पादन

एक पायलट स्टडी से पता चला कि चुने हुए बैक्टीरिया आइसोलेट्स और चिलेटेड ट्रेस मिनरल्स का इस्तेमाल करके आयरन और सेलेनियम से भरपूर बायोफ्लॉक की तैयारी मुमकिन है। इन खनिजों से भरपूर बायोफ्लॉक ने खनिजों को अच्छी तरह से अवशोषित कर बनाए रखा, लाभदायक माइक्रोबियल और रोटिफर आबादी को बढ़ावा दिया और न्यूट्रिएंट रीसाइक्लिंग को बेहतर बनाया। इससे बायोफ्लॉक आधारित जलीय कृषि प्रणाली की पोषण गुणवत्ता और स्थिरता को बढ़ाने की उनकी क्षमता का पता चलता है।

जिंक से समृद्ध बायोफ्लॉक सूक्ष्मजीवी संघ के उपयोग से पैसिफिक सफेद झींगों के नर्सरी परफॉर्मेंस का मूल्यांकन

पैतालीस दिनों के बायोफ्लॉक परीक्षण से पता चला कि जिंक सप्लीमेंटेशन (20 ppm $ZnSO_4$) ने *पीनियस वन्नामेय* पोस्ट लार्वा में वृद्धि, उत्तरजीविता, जिंक अवशोषण और एंटीमाइक्रोबियल पेप्टाइड जीन एक्सप्रेशन को काफी हद तक बढ़ाया। जिंक फोर्टिफाइड बायोफ्लॉक ने शरीर वजन में 37 प्रतिशत और विशिष्ट वृद्धि दर में 21 प्रतिशत की बढ़ोतरी की, साथ ही फीड कन्वर्जन रेश्यो को 22 प्रतिशत कम किया, जिससे बेहतर उत्पादकता, स्वास्थ्य और रोग प्रतिरोध क्षमता का पता चलता है।

केज–कम–पॉन्ड सिस्टम में सीबास, पर्लस्पॉट, मिल्कफिश और झींगे की बहु–प्रजातीय पालन की तुलना

पैंतालीस दिनों के एक बहु–प्रजातीय जलीय कृषि परीक्षण में, पिंजरे में पाले जाने वाले सीबास और पर्लस्पॉट को तालाब में पाले जाने वाले मिल्कफिश और टाइगर श्रिम्प के साथ मिलाकर पालन किया गया। इससे संसाधनों का कुशल उपयोग और संतोषजनक वृद्धि, उत्तरजीविता दर और पानी की अच्छी गुणवत्ता देखने को मिली। मिल्कफिश ने प्राकृतिक उत्पादकता का प्रभावी ढंग से इस्तेमाल किया, जबकि टाइगर श्रिम्प में तेजी से विकास देखा गया। यह एकीकृत केज–कम–पॉन्ड सिस्टम जलीय कृषि के लिए एक उत्पादक, टिकाऊ और आर्थिक रूप से लाभदायक तरीका है।

पंजाब के लवणीय जल वाले क्षेत्रों में एशियाई सीबास का परीक्षण

सर्दियों में पालन के लिए, RAS, मिट्टी के तालाबों और तापमान नियंत्रित पॉलीहाउस में हैचरी उत्पादित 1,000 सीबास अंगुलिकाएं (छोटी मछलियां) संग्रहीत की गईं, जिनका वजन 16 से 40 ग्राम था। 'सीबास ग्रोआउटप्लस' फीड खिलाने पर, मछलियों का औसत वजन (ABW) 08 महीनों में 580 ग्राम हो गया, जिससे अंतर्स्थलीय लवणीय क्षेत्रों में सीबास की खेती की संभावना साबित हुई।

तालाब में स्थापित पिंजरे में एशियाई सीबास मछलियों के पालन के लिए संग्रहण घनत्व का अनुकूलन

तालाब में स्थापित जाल से बने पिंजरे में एशियाई सीबास मछलियों को 180 दिनों तक पालन के एक परीक्षण से पता चला कि कम संग्रहण घनत्व (30 से 40 मछली प्रति घनमीटर) में, 50 मछली प्रति घनमीटर की तुलना में बेहतर वृद्धि, उत्तरजीविता और उत्पादन प्रदर्शन प्राप्त हुआ। अध्ययन में 40 मछली प्रति घनमीटर को सबसे सही संग्रहण घनत्व माना गया, जो समुदाय आधारित जलीय कृषि की पहलों के लिए व्यवहार्य और लाभदायक रणनीति है।

समुद्री शैवाल की विविधता और मौसमी बदलाव

तमिलनाडु में खारा जलीय 22 स्थानों पर समुद्री शैवाल की जैवविविधता में स्थान और मौसम के हिसाब से काफी अंतर देखा गया, जिसमें मुत्तुकाडु लैगून और कल्पक्कम को जैव–विविधता हॉटस्पॉट के तौर पर पहचाना गया।

सीवीड (समुद्री शैवाल) के साथ भारतीय सफेद झींगे का नर्सरी पालन

ग्रेसिलेरिया समुद्री शैवाल के साथ *पीनियस इंडिकस* के 45 दिवसीय सह–पालन परीक्षण ने झींगों की वृद्धि और कच्चे प्रोटीन की मात्रा को 63.56 प्रतिशत तक बढ़ा दिया। *जी. फोलिफेरा* में 0.97 प्रतिशत की तुलना में *जी. कॉर्टिकटा* ने 1.4 प्रतिशत की उच्च विशिष्ट वृद्धि दर हासिल की, जिससे यह मोनोकल्चर की तुलना में झींगा नर्सरी प्रदर्शन में सुधार के लिए अधिक प्रभावी प्रजाति बन गई।

एकीकृत झींगा पालन के लिए *कौलेर्पा* रेसेमोसा की घनत्व को अनुकूलित करना

संग्रहण घनत्व बढ़ने के साथ समुद्री शैवाल (सीवीड) की वृद्धि में काफी कमी आई। एक किलोग्राम प्रति वर्गमीटर के संग्रहण घनत्व पर 2.47 प्रतिशत की अधिक विशिष्ट वृद्धि दर हासिल हुई जबकि दो किलोग्राम प्रति वर्गमीटर पर यह दर 1.16 प्रतिशत थी; इससे पता चलता है कि तालाब आधारित राफ्ट कल्चर सिस्टम के लिए कम संग्रहण घनत्व सबसे अच्छा है।

सीवीड एकीकृत झींगा पालन (SISF) प्रणाली

अस्तर लगे तालाबों में *पीनियस वन्नामेय* के साथ *ग्रेसिलेरिया सैलिकोर्निया* का उपयोग करके समुद्री शैवाल एकीकृत झींगा पालन (SISF) से झींगों की वृद्धि, उपज और चारा दक्षता में सुधार हुआ। झींगो ने 23.2 ग्राम की उच्च औसत शरीर वजन और 1.36 की FCR साथ 9.1 टन प्रति हेक्टेयर उपज प्राप्त की। पानी की गुणवत्ता में सुधार और 12 टन प्रति हेक्टेयर समुद्री शैवाल उत्पादन ने प्रणाली के पारिस्थितिक और आर्थिक लाभों पर प्रकाश डाला।

कुरुमा झींगे की प्रजनन क्षमता

चेन्नई के तट से पकड़े गए कुल 186 वन्य प्रजनकों *पीनियस जपानिकस* में नर–मादा का अनुपात 2.7:1 पाया गया; इनमें नरों का औसत वजन 35.36 ग्राम (22–49 ग्राम) और मादाओं का 70 ग्रा (43 से 98 ग्राम) था। इन्हें बंद स्थितियों में सफलतापूर्वक परिपक्व और प्रजनन कराने में सफलता मिली और खारेपन को सहने की क्षमता के अध्ययन से पता चला कि 40 ppt खारेपन में इनकी बढ़त बेहतर रही।

ब्लू स्विमर क्रैब के लिए बेहतर फीडिंग प्रोटोकॉल

मेगालोपा से लेकर केकड़े के प्रथम चरण तक *पोर्टुनस रेटिकुलैटस* के पालन–पोषण को अनुकूलित करने के लिए सात आहारीय प्रोटोकॉल का मूल्यांकन किया गया। सह–आहार रण ानीतियां एकल आहारों से बेहतर साबित हुईं, जिसमें आर्टेमिया और तैयार फीड के संयोजन से उच्चतम उत्तरजीविता और रूपांतरण दक्षता प्राप्त हुई, जिससे यह सबसे प्रभावी लार्वा आहार प्रोटोकॉल बन गया।

ऑरेंज कीचड़ केकड़े का बंद प्रजनन

आईसीएआर–सीबा के काकद्वीप अनुसंध ान केंद्र में स्काइला *ऑलिवेसिया* के ब्रूडस्टॉक की परिपक्वता और प्रजनन सफलतापूर्वक संपन्न किया गया। नियंत्रित परिस्थितियों में आंतरिक परिपक्वता प्रणाली के अंतर्गत रखे गए वन्य मादा केकड़ों के आइस्टॉक विच्छेदन के पश्चात सफलतापूर्वक अंडोत्सर्जन हुआ, जिससे प्रति मादा 10 से 15 लाख अंडों का उत्पादन हुआ तथा अंडे फूटने (हैचिंग) की दर 70 प्रतिशत से 78 प्रतिशत दर्ज की गई।

पोर्सिलेन केकड़े का लार्वा पालन

नियोपेट्रोलिस्टेस मैकुलेटस का सफल हैचिंग और प्रारंभिक लार्वा पालन 28 ppt लवणता और 28 ± 1°सें. तापमान पर प्राप्त किया गया। छह दिनों के भीतर लार्वा जोइया II अवस्था तक विकसित हुए। 15 दिनों के बाद आहार ग्रहण दक्षता कम होने के कारण मृत्यु दर अधिक रही। आगे, लार्वा चक्र को पूर्ण करने हेतु अनुकूलित आहार प्रोटोकॉल तथा जल गुणवत्ता प्रबंधन की आवश्यकता है।

हरे कीचड़ केकड़े के नर्सरी पालन के लिए आश्रय सबस्ट्रेट

स्काइला सेर्राटा के मेगालोपा से केकड़ा इंस्टार अवस्था तक नर्सरी पालन हेतु पांच आश्रय सबस्ट्रेट का मूल्यांकन किया गया। सभी सबस्ट्रेट ने परस्पर भक्षण को कम करके नियंत्रण की तुलना में उत्तरजीविता की दर में उल्लेखनीय सुध ाार किया। टूटे हुए टाइल, क्लैम शेल तथा नारियल की पत्तियां सर्वाधिक प्रभावी रहीं, जबकि वृद्धि सभी उपचारों में समान रही।

एशियन सीबास ब्रूडस्टॉक में हार्मोन प्रेरित समयपूर्व परिपक्वता

प्रोटैंड्रस एशियन सीबास ब्रूडस्टॉक में हार्मोन की सहायता से समयपूर्व परिपक्वता के लिए निरंतर रिलीज होने वाले GnRH एनालॉग के साथ 17α.मिथाइलटेस्टोस्टेरोन या 17β-एस्ट्राडियोल का प्रयोग करके सफलापूर्वक वीर्यस्राव को प्रेरित किया गया तथा डिंबग्रंथि विकास को उन्नत किया गया। छह बार अंडोत्सर्जन से 5,00,000 अंडे प्राप्त किए गए, जिनमें निषेचन और लार्वा उत्तरजीविता दर पारंपरिक बड़े ब्रूडस्टॉक से प्राप्त होने वाले अंडों के बराबर थी।

सीबा निर्मित आहार पर विशेष रूप से पोशित सीबास ब्रूडस्टॉक की बंद स्थितियों में परिपक्वता

नव संकलित एषियाई सीबास उप–वयस्कों को कच्चे तालाब में ब्रूडस्टॉक के रूप में पाला गया और उन्हें सीबा निर्मित ब्रूडस्टॉक आहार दिया गया। नर एवं मादा दोनों ने दिसंबर में

परिपक्वता प्राप्त की, जिससे केवल सीबा निर्मित आहार पर पोशित एषियाई सीबास ब्रूडस्टॉक की पहली बंद परिपक्वता दर्ज की गई।

मिल्कफिष ब्रूडस्टॉक की सतत परिपक्वता तथा बीज उत्पादन

आरसीसी टैंकों तथा पर्यावरण नियंत्रित पुनःपरिसंचरण जलीय प्रणाली में रखे गए मिल्कफिष ब्रूडस्टॉक में मासिक हार्मोन प्रत्यारोपण के पष्चात सतत परिपक्वता देखी गई। छह सफल अंडोत्सर्जनों से 45,500 पोने प्राप्त हुए, जिन्हें तमिलनाडु, गुजरात, ओडिषा, असम तथा पष्चिम बंगाल के हितधारकों को वितरित किया गया।

मैंग्रोव रेड स्नैपर के प्रजनन का बड़े पैमाने पर विस्तार कर सामूहिक बीज उत्पादन

मौसमीय ब्रूडस्टॉक परिपक्वता अध्ययनों तथा प्रेरित प्रजनन परीक्षणों के माध्यम से मैंग्रोव रेड स्नैपर *(लुटजानस अर्जेन्टिमैकुलेटस)* के बंद प्रजनन का मानकीकरण किया गया। जननग्रंथि विकास, षुक्राणु गुणवत्ता, अंडोत्सर्जन प्रदर्षन, निशेचन, हैचिंग तथा लार्वा पालन के प्रोटोकॉल स्थापित किए गए। सफल अंडोत्सर्जन से 3.51 लाख अंडे प्राप्त हुए, जिनमें 70 प्रतिषत निशेचन दर तथा 75 प्रतिषत हैचिंग दर दर्ज की गई।

गोल्डलाइन्ड सीब्रीम का बंद प्रेरित प्रजनन

गोल्डलाइन्ड सीब्रीम, रैब्डोसार्गस सार्बा के ब्रूडस्टॉक विकास का कार्य किषोर तथा वन्य जनकों के बंदी पालन और अनुकूलन के माध्यम से किया गया। 80 प्रतिषत ब्रूडस्टॉक में जननग्रंथि परिपक्वता प्राप्त की गई तथा HCG का उपयोग कर प्रेरित प्रजनन परीक्षण किए गए। यद्यपि, अंडोत्सर्जन प्राप्त नहीं हो सका, तथापि, प्रजनन तत्परता की पुश्टि हुई, जिससे भविश्य के प्रजनन हस्तक्षेपों के लिए मार्ग प्रषस्त हुआ।

स्ट्रिक्ड स्पाइनफुट के ब्रूडस्टॉक संग्रहण तथा जननग्रंथि परिपक्वता का आकलन

स्ट्रिक्ड स्पाइनफुट, *सिगानस जावस* के ब्रूडस्टॉक विकास को बंदी पालन, प्रजनन निगरानी तथा हार्मोनल हस्तक्षेपों के माध्यम से सुदृढ़ किया गया। जननग्रंथि परिपक्वता के मौसमीय प्रतिरूप, लिंगानुपात तथा प्रथम परिपक्वता पर लंबाई का निर्धारण किया गया। हार्मोन पेलेट प्रत्यारोपण (LHRHa) ने अंडाणु वृद्धि में उल्लेखनीय वृद्धि की, जिससे ब्रूडस्टॉक परिपक्वता में तीव्रता लाने की इसकी क्षमता प्रदर्षित हुई।

केकड़ा हैचरी प्रबंधन हेतु आईओटी आधारित स्वचालित जीवित आहार प्रणाली

केकड़ा हैचरियों के लिए सटीक, स्वचालित आहार वितरण तथा वास्तविक समय निगरानी सुनिष्चित करने के लिए आईओटी आधारित स्वचालित जीवित आहार प्रणाली विकसित की गई। इस प्रणाली ने श्रम पर निर्भरता को कम किया, आहार वितरण की सटीकता में सुधार किया तथा लार्वा की समान वृद्धि और उत्तरजीविता में सहायता प्रदान की। इसकी अनुकूलनीय तथा विस्तरणीय संरचना हैचरी की दक्षता, स्थिरता और विष्वसनीय केकड़ा बीज उत्पादन को बढ़ाती है।

ग्रीन पफर फिष का बंद प्रजनन

ग्रीन पफर फिष, टेट्राओडॉन *फ्लुवियाटिलिस* के ब्रूडस्टॉक को सफलतापूर्वक अनुकूलित किया गया तथा LHRHa का उपयोग का अंडोत्सर्जन हेतु प्रेरित किया गया, जिसमें 72 घंटों के भीतर प्रति मादा 50,000 से 1,20,000 अंडों का उत्पादन हुआ। जीवित तथा सूत्रबद्ध आहार का उपयोग करते हुए प्रारंभिक लार्वा पालन अध्ययनों में 20 प्रतिषत उत्तरजीविता दर प्राप्त हुई।

कच्चे तालाबों में हिल्सा की बंद परिपक्वता

नर तथा मादा दोनों में हिल्सा ब्रूडस्टॉक ने खारा जल के तालाब प्रणाली में 80 प्रतिषत से अधिक परिपक्वता प्राप्त की। मादा के अंडाणुओं का व्यास 551 से 684 माइक्रोमीटर के बीच रहा, जबकि नर षुक्राणु गतिषीलता स्कोर 3, षुक्राणु सक्रियता अवधि 2 से 3 मिनट तथा घनत्व 5.38 × 10^9 कोषिकाएं दर्ज किया गया।

झींगा आहार में प्रटीन के वैकल्पिक स्रोत के तौर पर राइस DDGS

पीनियस वन्नामेय के आहार में सोयाबीन मील की जगह चावल के DDGS को 0, 10, 20 और 30 प्रतिशत

की दर से मिलाकर जांच की गई। वृद्धि दर, स्वास्थ्य की स्थिति या हिस्टोपैथोलॉजिकल पैमाने में कोई खास अंतर नहीं देखा गया। इससे यह पता चलता है कि झींगे के आहार में इसे प्रोटीन के एक विकल्प के तौर पर उपयोग किया जा सकता है।

एनर्जी और फंक्शनल फीड सामग्री के तौर पर सुनहरे और बैंगनी शकरकंद

पोषण संबंधी जांच से पता चला है कि सुनहरे और बैंगनी शकरकंद के आटे में कार्बोहाइड्रेट्स की मात्रा भरपूर होते हैं। ये मछलियों के आहार में ऊर्जा के वैकल्पिक स्रोत के तौर पर उपयुक्त हैं। गेहूं की 33% मात्रा को शकरकंद के आटे से बदलने पर मछलियों के रंग में सुधार देखा गया, जिससे पता चलता है कि सजावटी मछलियों को रंग देने के लिए यह एक उपयोगी आहार सामग्री हो सकती है।

टाइगर गोबी के लिए आहार प्रोटीन की जरूरत का अनुकूलन

टाइगर गोबी (*Mugilogobius tigrinus)* के लिए जरूरी डाइटरी प्रोटीन की मात्रा का पता लगाने के लिए एक फीडिंग ट्राइल किया गया, जिसमें 25, 30, 35, 40 और 45 प्रतिशत क्रूड प्रोटीन वाले आहारों का मूल्यांकन किया गया। 35, 40 प्रतिशत डाइटरी प्रोटीन स्तर पर सबसे अच्छी वृद्धि देखी गई, जिससे जलीय कृषि उत्पादन के लिए पोषण के लिहाज से संतुलित आहार बनाने का आधार मिला।

व्हाइटलेग झींगे में वृद्धि से जुड़े जीन

एक्सप्रेशन और गट माइक्रोबायोटा पर कॉटनसीड मील के उपयोग का प्रभाव

पीनियस वन्नामेय के आहार में कॉटनसीड मील (CSM) को शामिल करने से वृद्धि और मेटाबॉलिज्म से जुड़े जीन एक्सप्रेशन पर असर पड़ा। CSM का स्तर बढ़ाने से IGF-II, PM, PFK और FAS जीन का एक्सप्रेशन काफी कम हो गया, जब कि जिन झींगों को 0% (CS0) और 15% (CS15) CSM वाला आहार दी गई उनमें आंतों के माइक्रोबियल डाइवर्सिटी और कम्युनिटी स्टेबिल्टी ज्यादा बनी रही।

व्हाइटलेग झींगों के विकास, प्रतिरक्षा और आंत माइक्रोबायोम पर किण्वित सूरजमुखी की खली का आहार में समावेशन

सूरजमुखी की खली के किण्वन से उसकी पोषक गुणवत्ता में सुधार हुआ, इससे क्रूड प्रोटीन और जरूरी अमिनो एसिड की मात्रा बढ़ी, जब कि फाइबर और टैनिन व सैपोनिन जैसे एंटी–न्यूट्रिशनल तत्वों की मात्रा कम हुई।

छोटे ब्लू स्विमर केकड़ों के आहार में प्रोटीन आवश्यकता की सही मात्रा का निर्धारण

छोटे ब्लू स्विमर केकड़ों के आहार में प्रोटीन आवश्यकता का 90 दिनों तक अध्ययन किया गया। जिन केकड़ों को 40 प्रतिशत वाला आहार दिया गया, उनकी वृद्धि और आहार उपयोग बेहतर रहा। आहार में प्रोटीन की मात्रा 40 प्रतिशत से बढ़ाने पर वृद्धि में कोई खास सुधार नहीं हुआ, जिससे पता चलता है कि केकड़ा पालन के लिए उनके आहार में 40 प्रतिशत प्रोटीन सही मात्रा है।

प्लैंकटनप्लस और चिंगुड़ीप्लस आहार के पूरक उपयोग से झींगा आंत माइक्रोबायोटा का लाभकारी माड्यूलेशन

प्लैंकटनप्लस और चिंगुड़ीप्लस आहार के पूरक उपयोग से लाभकारी *लैक्टोकोकस* प्रजातियों की सापेक्ष प्रचुरता में उल्लेखनीय वृद्धि हुई, जबकि संभावित रोगजनक *विब्रियो* प्रजातियों की प्रचुरता में कमी दर्ज की गई, जो आंत्र सूक्ष्मजीव स्वास्थ्य में सुधार का संकेत देती है।

लार्वा के पोशण हेतु डीएचए–समृद्ध थ्रॉस्टोकाइट्रिड

पिचावरम मैंग्रोव से पृथक किए गए डीएचए–समृद्ध थ्रॉस्टोकाइट्रिड ऑरैन्टियोकाइट्रियम ऐसेटोफाइलम की वृद्धि को 25 ppt लवणता पर अनुकूलित किया गया, जिससे 43.71 प्रतिषत वसा तथा 37.77 प्रतिषत प्रोटीन के साथ उच्च जैवभार प्राप्त हुआ। जीवित ए. *ऐसेटोफाइलम* से समृद्ध *आर्टेमिया* में 90.3 मिलीग्राम की सर्वाधिक वृद्धि तथा 97.77 प्रतिषत उत्तरजीविता दर प्राप्त हुई, जिससे लार्वा आहार समृद्धि के लिए इसकी श्रेश्ठ क्षमता प्रदर्षित हुई।

भारत में प्रमुख झींगा रोगों की निगरानी

पूरे भारत में WHOA द्वारा सूचीबद्ध रोगों के लिए 152 झींगा फार्मों पर किए गए निगरानी अध्ययन से व्हाइट स्पॉट सिंड्रोम (19 प्रतिषत) और ईएचपी संक्रमण (10.5 प्रतिषत) की निरंतर प्रध ानता का पता चला है। निश्कर्श झींगा पालन में रोगों के सतत भार तथा उन्नत निदान, जैवसुरक्षा और समेकित रोग प्रबंध न रणनीतियों की आवष्यकता को रेखांकित करते हैं।

WSSV-संक्रमित झींगों में खुराक निर्भर प्रतिरक्षा विनियमन

पीनियस वन्नामेय में WSSV की विभिन्न खुराकों द्वारा किए गए प्रायोगिक संक्रमण से स्पश्ट खुराक–निर्भर प्रतिरक्षा प्रतिक्रिया देखी गई। 10^2 प्रतियों की उच्च विशाणु खुराक ने तीव्र विशाणु प्रतिकृति, हिमोसाइट्स में उल्लेखनीय कमी तथा संक्रमण के 07 दिन बाद IL-16 की उच्चतम अभिव्यक्ति उत्पन्न की, जबकि छोटी खुराकों में रोग की प्रगति विलंबित रही, जिससे विशाणु भार और रोग की गंभीरता के बीच स्पश्ट संबंध प्रदर्षित हुआ।

झींगा फार्मों में रनिंग मॉर्टेलिटी सिंड्रोम का प्रभाव

तमिलनाडु के नागपट्टिनम जिले में रनिंग मॉर्टेलिटी सिंड्रोम के व्यवस्थित सर्वेक्षण से 60 प्रतिषत तक प्रसार का पता चला। इस रोग के कारण 1.85 टन प्रति हेक्टेयर का उल्लेखनीय उत्पादन क्षति तथा प्रति हेक्टेयर 0.84 मिलियन रूपये की अनुमानित राजस्व क्षति हुई, जो इसके महत्वपूर्ण आर्थिक प्रभाव को दर्षाता है।

रोगग्रस्त कीचड़ केकड़ों के स्वास्थ्य का आकलन

तमिलनाडु तथा केरल से एकत्रित रोगग्रस्त कीचड़े केकड़ों *(स्काइल सेर्राटा)* के नमूने कीचड़ केकड़ा रियोवायरस, WSSV, EHP तथा परजीवी संक्रमण से मुक्त पाए गए। तथापि, अन्य मौकापरस्त पर्यावरणीय *विब्रियो के साथ विब्रियो एल्जिनोलाइटिकस, मेरिनोबैक्टर नौटिकस तथा एरोमोनास* प्रजातियों के संक्रमण पाए गए।

एषियन सीबास में मोनोजीनियन गिल परजीवी

एषियन सीबास में मोनोजीनीय गिल परजीवी, *डोलिसिरोटप्लेकटेनम* पेनांगी की 100 प्रतिषत प्रसार दर से साथ पहचान की गई। इसके कारण संक्रमित मछली टैंकों और पुनःसंचारित जलजीव पालन प्रणाली में रोजाना 2 से 3 मछलियों की मृत्यु हो रही थी। हर मछली में औसतन 42.91 ± 19.37 परजीवी पाए गए जिससे मछलियों को बहुत ज्यादा स्ट्रैस हुआ और उनके फेफड़ों में गंभीर षारीरिक समस्याएं देखी गईं।

एषियन सीबास मसल सेल लाइन की स्थापना

एषियन सीबास की मसल सेल लाइन की 175 पासेज़ के साथ स्थापना की गई। सेल लाइन के आणविक अभिलक्षण द्वारा इसकी उत्पत्ति की पुश्टि की गई। विभेदन माध्यम द्वारा प्रेरण के मष्चात मायोब्लास्ट विकसित होकर मायोट्यूब तथा मायोफाइब्रिल में परिवर्तित हुए। कोषिका जनसंख्या ने 21 घंटे, 19 मिनट का द्विगुणन समय लिया, जो सुदृढ़ वृद्धि का संकेत है।

WSSV और EHP की त्वरित CRISPR आधारित पहचान

सीमित संसाधन वाले क्षेत्रों में WSSV तथा EHP की त्वरित पहचान हेतु अत्याधुनिक जीन एडिटिंग प्रौद्योगिकियां विकसित की गईं। फिल्टर पेपर आधारित सरल न्यूक्लिक अम्ल निश्कर्शण विधि द्वारा उपकरण रहित नमूना प्रसंस्करण संभव हुआ। WSSV की पहचान वन–पॉट RPA–CRISPR/Cas12a परीक्षण द्वारा की गई, जबकि EHP की पहचान आरपीए आधारित नैदानिक पद्धति से 20 मिनट के भीतर की गई।

विब्रियो प्रजातियों हेतु ट्रिप्लेक्स मात्रात्मक वास्तविक समय पीसीआर

नवीन पैनजीनोम व्युत्पन्न मार्कर जीनों का उपयोग कर *विब्रियो पैराहीमोलाइटिकस, विब्रियो हार्वेयी तथा विब्रियो कैंपबेल्ली* की त्वरित पहचान तथा परिमाणीकरण हेतु अत्यधिक संवेदनषील और विषिश्ट मात्रात्मक वास्तविक समय पीसीआर परीक्षण विकसित किया गया। इस परीक्षण ने जलीय रोगजनकों के विरूद्ध 100 प्रतिषत संवेदनषीलता तथा विषिश्टता प्रदर्षित की, जिससे जलीय कृशि में विब्रियोसिस के प्रारंभिक निदान और निगरानी हेतु एक विष्वसनीय साधन उपलब्ध हुआ।

WSSV तथा EHP की एक साथ पहचान हेतु मल्टीप्लेक्स LAMP परीक्षण

WSSV तथा EHP की एक साथ पहचान हेतु मल्टीप्लेक्स LAMP आधारित लैटरल फ्लो परीक्षण विकसित किया गया। इस परीक्षण ने 55 मिनट के भीतर न्यूनतम 10 लक्ष्य प्रतिकृतियों का पता लगाया तथा 100 प्रतिषत नैदानिक संवेदनषीलता और विषिश्टता प्राप्त की, जिससे नियमित फार्म स्तरीय निगरानी हेतु एक सरल बिंदु देखभाल उपाय उपलब्ध हुआ।

सीबा ईएचपी क्यूरा ग्रो+

सीबा ईएचपी क्यूरा ग्रो+ का पांच राज्यों के 104 झींगा फार्मों में प्रमाणीकरण किया गया, जिससे ईएचपी तथा विब्रियो भार में उल्लेखनीय कमी और तथा 75 प्रतिषत फार्मों में व्हाइट फीकल सिंड्रोम नियंत्रित हुआ। इस उत्पाद ने एक वर्श तक स्थिरता प्रदर्षित की तथा उत्तरजीविता की दर 67 प्रतिषत से बढ़कर 80 प्रतिषत हुई, एफसीआर 1.71 से घटकर 1.37 हुआ और उत्पादन में 62 प्रतिषत की वृद्धि हई।

सीबा ईएचपी क्यूरा ग्रो+ का राश्ट्रव्यापी प्रसार

सीबा ईएचपी क्यूरा ग्रो+ के अंगीकरण को बढ़ावा देने हेतु NFDB के सहयोग से राश्ट्रव्यापी जनसंपर्क कार्यक्रम आयोजित किए गए। इन कार्यक्रमों में 600 से अधिक किसानों ने भाग लिया, क्षेत्रीय विस्तार पुस्तिकाओं का विमोचन किया गया तथा बड़े पैमाने पर क्षेत्रीय अंगीकरण और जागरूकता के समर्थन हेतु निरूपण मात्रा का वितरण किया गया।

वयरल नर्वस नेक्रोसिस के लिए माइक्रोएल्गी आधारित वैक्सीन

कोडोन अनुकूलित एनएनवी जीन वहन करने वाले पुनर्संयोजित प्लास्मिड को विद्युत छिद्रीकरण के माध्यम से सफलतापूर्वक *क्लैमाइडोमोनास रेनहार्डटीआई* में रूपांतरित किया गया। पुनर्संयोजित कॉलोनियों में समावेषन की उपस्थिति सत्यापित की गई तथा परिणामस्वरूप एनएनवी कैप्सिड प्रोटीन व्यक्त करने वाले क्लोन, विशाणुजनित तंत्रिका ऊतक परिगलन से पखमीन मछलियों के लार्वा की सुरक्षा हेतु मौखिक अथवा निमज्जन टीके के रूप में संभावनाषील पाए गए।

समुद्री षैवाल अधिपादपों का नियंत्रण

अधिपादप *कोलाकोनेमा* प्रजाति से संक्रमित *ग्रेसिलेरिया कॉर्टिकाटा* का उपचार पोविडोन–आयोडीन की विभिन्न सांद्रताओं (0.5 प्रतिषत से 02 प्रतिषत) तथा विभिन्न अवधियों (30 सेकंड, 01 मिनट तथा 03 मिनट) पर किया गया। इमेज जे आधारित कलोरोफिल विरंजन विष्लेशण से पुश्टि हुई कि 03 मिनट के लिए 01 से 02 प्रतिषत पोविडोन–आयोडीन ने 48 घंटों के भीतर 90 प्रतिषत से अधिक प्रभावकारिता प्राप्त की, जिससे एक प्रभावी उपषमन रणनीति उपलब्ध हुई।

विब्रियो हार्वेयी तथा *विब्रियो पैराहीमोलाइटिक्स* का तुलनात्मक जीनोमिक विष्लेशण

विब्रियो हार्वेयी के 216 जीनोमों के जीनोमिक विष्लेशण से लगभग 80 प्रतिषत कोर जीनों सहित अत्यधिक संरक्षित जीनोम तथा टाइप II, III तथा V स्रवण तंत्र सहित प्रमुख कोर विशाणुता निर्धारकों का पता चला। व्हाइट फीकल सिंड्रोम से ग्रस्त झींगे से पृथक किए गए *विब्रियो पैराहीमोलाइटिक्स* F10G1 में 5.37 मेगाबेस जीनोम पाया गया, जिसमें दो गुणसूत्र और एक प्लास्मिक मौजूद थे, साथ ही अक्षुण्ण प्रोफेज, CRISPR-Cas तंत्र, सुपरइंटीग्रॉन तथा प्लास्मिड कोडित टाइप IV स्रवण तंत्र सहित विशाणुता सम्बद्ध तत्व पाए गए।

ShEnrich : झींगा विषिश्ट एनोटेषन तथा समृद्धि विष्लेशण प्लेटफार्म

ShEnrich पेनाइड झींगों हेतु एक कार्यात्मक एनोटेषन तथा समृद्धि विष्लेशण प्लेटफार्म है। यह प्लेटफार्म तुलनात्मक जीनोमिक्स तथा समृद्धि कार्यप्रवाह को सक्षम बनाता है तथा क्रस्टेषियनों के लिए सुदृढ़ एनोटेषन उपकरणों की कमी को दूर करता है।

झींगा हेतु SSR मार्कर डेटाबेस : *पीनियस इंडिकस, पीनियस जेपोनिकस, पीनियस वन्नामेय, पीनियस चिनेन्सिस* तथा *पीनियस मोनोडॉन* जीनोम संयोजन में SSRs का पूर्वानुमान लगा कर 4.4 करोड़ मार्करों वाला SSR मार्कर डेटाबेस निर्मित किया गया।

झींगा हेतु PIT टैगिंग : पूंछ की मांसपेषी में टैग लगाकर व्यक्तिगत पहचान हेतु झींगा में पीआईटी टैगिंग की उपयोगिता का मानकीकरण किया गया। इसका उपयोग आनुवंषिक सुधार कार्यक्रमों में किया जा सकता है।

भारतीय सफेद झींगा हेतु मल्टीप्लेक्स एसएसआर मार्कर पैनल : 24 मार्करों वाले छह मल्टीप्लेक्स एसएसआर मार्कर

पैनल विकसित किए गए, जिनका संभावित उपयोग आनुवंषिक सुधार कार्यक्रमों में किया जा सकता है।

लवणता स्ट्रैस तथा आहार व्यवस्थाओं के अंतर्गत झींगा की आंत्र सूक्ष्मजीवी प्रोफाइल

इस अध्ययन से ज्ञात हुआ कि उच्च लवणता की स्थिति में आंत्र सूक्ष्मजीवी विविधता में कमी आती है, जबकि उच्च वसायुक्त आहार *पीनियस इंडिकस* में इसे बढ़ाता है। ये सूक्ष्मजीवी समुदाय ऊर्जा समसििति तथा वसीय अम्ल जैवसंष्लेशण का विनियमन करते हैं, जिससे यह प्रदर्षित हुआ कि कार्यात्मक उच्च वसा आहार आंत्र सूक्ष्मजीव समुदाय में परिवर्तन कर झींगा को अतिलवणीय स्ट्रैस कम करने में सहायता करता है।

WSSV आइसोलेट्स में विविधता

विषिश्ट जीनोम क्षेत्रों के आधार पर WSSV संक्रमित *पीनियस इंडिकस* झींगा नमूनों के तुलनात्मक जीनोमिक विष्लेशण से चैनीज, आस्ट्रेलियाई, भारतीय तथा इक्वाडोर आइसोलेटों की मौजूदगी का पता चला।

WSSV संक्रमित भारतीय सफेद झींगा में तापमान निर्भर ट्रांसक्रिप्षनल परिवर्तन

WSSV संक्रमित *पीनियस इंडिकस* को 27 °C, 30 °C तथा 33 °C. के भिन्न तापमानों पर 12, 14 और 48 hpi के दौरान तुलनात्मक जीन समूह समृद्धि विष्लेशण से विभिन्न परिस्थितियों में जीन अभिव्यक्ति स्तरों में भिन्नता पाई गई। विषेश रूप से 24–48 hpi के दौरान 30 °C. तथा 33 °C. पर काइटिन आध ाारित क्यूटिकल विकास, ऊश्मा प्रतिक्रिया तथा प्रोटीन रिफोल्डिंग से संबंधित मार्ग अत्यधिक समृद्ध पाए गए।

WSSV संक्रमित वन्य भारतीय झींगा में आंत्र सूक्ष्मजीविता का विघटन : WSSV संक्रमित झींगा में *फोटोबैक्टैरियम* का स्पश्ट प्रभुत्व देखा गया, जबकि असंक्रमित झींगा में *एनहाइड्रोबैक्टर, डायलिस्अर* तथा *बिफिडोबैक्टेरियम* जैसे लाभकारी जीवाणु प्रमुख थे। सहजीवी जीवों की हानि तथा रोगजनकों की वृद्धि ने विशाणुजनित स्ट्रैस से उत्पन्न सूक्ष्मजीवी असंतुलन को दर्षाया।

एम्प्लिकॉन सिक्वेंस आंकड़ों हेतु प्रसरण आधारित सूक्ष्मजीवी नेटवर्क विष्लेशण : एम्प्लिकॉन सिक्वेंष आंकड़ों के विष्लेशण हेतु स्लोप आधारित, चिन्हित प्रतिगमन की एक नवीन पद्धति का उपयोग किया गया। इसके माध्यम से पारंपरिक प्रचुरता आधारित मानदंडों के स्थान पर सूक्ष्मजीवों के बीच दिषात्मक पारिस्थितिक अंतःक्रियाओं का अनुमान लगाया गया। यह प्रदर्षित किया गया कि सूक्ष्मजीवी अंतःक्रिया की लचीलापन सूक्ष्मजीव समुदाय के विघटन का एक संवेदनषील संकेतक है।

प्रोबायोटिक तथा हैलो–सहिश्णु जीवाण ुओं का पैन–जीनोम विष्लेशण

189 हैलो सहिश्णु *बैसिलस* स्ट्रेनों के पैन–जीनोमिक विष्लेशण से एक खुले पैन–जीनोम की पहचान की गई, जिसमें प्रोबायोटिक गुण, विशाणुता कारक तथा प्रतिजैविक विरोधी जीन सम्मिलित थे। अध्ययन में *बैसिलस एमाइलोलिक्विफेसिएन्स* की 10 स्ट्रेनों को संभावित प्रोबायोटिक प्रजातियों के रूप में चिन्हित किया गया, क्योंकि इनमें प्रतिजैविक प्रतिरोध तथा विशाणुता कारक अनुपस्थित थे।

एषियाई सीबास हेतु गुणसूत्र स्तरीय जीनोम संयोजन : एषियाई सीबास के जीनोम का विष्लेशण किया गया, जिसकी लंबाई 614.9 मेगाबेस तथा एन50 लंबाई 26.45 मेगाबेस पाई गई। इसका 98.9 प्रतिषत पूर्ण होना आकलित किया गया तथा इसमें 30,014 प्रोटीन संकेतन जीनों का अनुमान लगाया गया।

लॉन्ग व्हिस्कर्स कैटफिष का गुणसूत्र स्तरीय जीनोम संयोजन : *मिस्टस गुलियो* की 706.32 मेगाबेस लंबाई वाले 108 स्कैफोल्ड में गुणसूत्र स्तरीय जीनोम तथा पूर्ण लंबाई ट्रांसक्रिप्टोम तैयार किया गया, जिनकी एन50 लंबाई 22.79 मेगाबेस रही। अंतिम संयोजन में 29 गुण ासूत्र स्तरीय स्कैफोल्ड सम्मिलित थे। ट्रांसक्रिप्टोम आंकड़ों का समेकित उपयोग कर 23,339 प्रोटीन संकेतन जीनों का अनुमान लगाया गया।

स्पाइनफुट रैबिट फिष हेतु गुणसूत्र स्तरीय जीनोम संयोजन : रैबिट फिष के लिए 583.1 मेगाबेस लंबाई तथा 36 स्कैफोल्ड में 25.71 मेगाबेस एन50 मान वाला गुणसूत्र स्तरीय जीनोम संयोजन तैयार किया गया। इस संयोजन में 99.15 प्रतिषत BUSCO पूर्णता तथा 29,902 प्रोटीन संकेतन पाए गए।

सामूहिक चयन द्वारा पर्लस्पॉट में उन्नत वृद्धि प्रदर्षन

F2 जनसंख्या में छह, आठ तथा नौ महीनों में क्रमषः षरीर भार में 12 प्रतिषत, 15.2 प्रतिषत तथा 16.5 प्रतिषत श्रेश्ठता दर्ज की गई।

जीन संपादन हेतु सिंगल गाइड RNAs का संष्लेशण तथा प्रमाणीकरण

एषियाई सीबास (लेट्स कैल्कैरिफर) तथा पर्लस्पॉट (एट्रोप्लस सुराटेन्सिस) में मायोस्टेनिन *(mstn)* को लक्ष्य करने वाले सिंगल गाइड RNAs (sgRNAs) का संष्लेशण किया गया तथा T7 एंडोन्यूक्लिएज I (T7E1) परीक्षण द्वारा उनकी कटिंग दक्षता का प्रमाणीकरण किया गया। विद्युत छिद्रीकरण परिस्थितियों का अनुकूलन किया गया तथा उपचारित अंडों में ल्यूसिफर येलो फ्लोरोसेंट डाई के सफल अवषोशण द्वारा उसका प्रमाणीकरण किया गया।

अंतर्स्थलीय लवणीय क्षेत्रों में स्रोत जल तथा मृदा का अभिलक्षणण

हरियाणा तथा राजस्थान के अंतर्स्थलीय लवणीय क्षेत्रों में किए गए सर्वेक्षणों से मृदा तथा जल में खनिजों की कमी के साथ–साथ भूजल तथा संवर्धन प्रणालियों में सल्फेट की निरंतर उच्च सांद्रता का पता चला। निश्कर्शों से संकेत मिलता है कि इन क्षेत्रों में सतत झींगा पालन हेतु खनिज अनुपूरण तथा क्षारीयता सुधार आवष्यक है।

पुराने झींगा पालन तालाबों का पुनरूद्धार

कार्बनिक संषोधकों : ह्यूमस, वर्मी कम्पोस्ट तथा गोबर की खाद ने पुराने

झींगा पालन तालाबों में उपलब्ध पोशक तत्वों तथा सूक्ष्मजीवी सक्रियता में सुधार किया। मृदा उर्वरता बढ़ाने में ह्यूमस सर्वाधिक प्रभावी पाया गया, इसके बाद वर्मी कम्पोस्ट तथा गोबर की खाद का स्थान रहा।

सुंदरबन के विभिन्न जलीय कृशि माडलों में पोशक तत्व गतिकी

पष्चिम बंगाल के दक्षिण 24 परगना में झींगा पालन प्रणालियों में फसलोत्तर पोशक तत्वों का उल्लेखनीय संचय तथा अधिक परिवर्तनषीलता देखी गई, जबकि बहुपालन प्रणालियां तुलनात्मक रूप से स्थिर रहीं।

पीएच तथा अमोनिया स्ट्रैस के संपर्क में व्हाइटलेग श्रिम्प में रिस्पाइरेट्री ब्रस्ट तथा अपोप्टोसिस

पीनियस वन्नामेय को पीएच 7.5, 9.0 तथा 10.5 के संयोजनों के साथ 3, 6, तथा 9 पीपीएम TAN नाइट्रोजन स्तरों पर रखा गया। 24, 48 तथा 96 घंटों पर प्रवाह साइटोमेट्री द्वारा हीमोलिम्फ विष्लेशण में पीएच 10.5 तथा 9 पीपीएम आमेनिया पर 96 घंटे में रिस्पाइरेट्री ब्रस्ट सक्रियता का उच्चतम स्तर पाया गया, जबकि अपोप्टोसिस 14 प्रतिषत से 62 प्रतिषत के बीच रहा।

कम लागत वाला स्वदेषी विद्युत रासायनिक पीएच संवेदक

जलीय कृशि तालाबों में पीएच मापन हेतु पॉलिएनिलीन तथा ग्राफीन नैनोकणों से संषोधित स्क्रीन–प्रिंटेड कार्बन इलेक्ट्रोड निर्मित किए गए। संवेदक ने पीएच 6–11 की सीमा में रैखिक प्रतिक्रिया प्रदर्षित की, साथ ही लवणीय जल में उच्च स्थिरता तथा विष्वसनीय प्रदर्षन दिखाया। षुद्धता मानकों तथा उच्च पुनरावृत्तता ने वास्तविक समय पीएच निगरानी हेतु इसकी उपयुक्तता की पुश्टि की।

कॉपर पोर्फिरिन आधारित विद्युत रासायनिक नाइट्राइट संवेदक

कॉपर पोर्फिरिन संषोधित स्क्रीन प्रिंटेड कार्बन इलेक्ट्रोड का उपयोग कर एक संवदेनषील विद्युत रासायनिक नाइट्राइट संवेदक विकसित किया गया। इलेक्ट्रोड निक्षेपण तथा सतही सक्रियण ने उत्प्रेरक प्रदर्षन में सुधार किया, जिससे व्यापक सांद्रता सीमा में उत्कृश्ट रैखिकता प्राप्त हुई। अनेक इलेक्ट्रोडों पर उच्च पुनरूत्पादकता ने वास्तविक समय जलीय कृशि जल गुणवत्ता निगरानी हेतु इस संवेदक की विष्वसनीयता सिद्ध की।

महाराश्ट्र में उत्तरदायी जलीय कृशि विस्तार

भूमि उपयोग प्रतिरूप, जल गुणवत्ता, मृदा विषेशताओं, CRZ विनियमों तथा CAA दिषा–निर्देषों को समेकित करने वाले भू–स्थानिक दृश्टिकोण का उपयोग कर महाराश्ट्र में उत्तरदायी जलीय कृशि विस्तार हेतु उपयुक्त क्षेत्रों की पहचान की गई। मानचित्रण, क्षेत्रीय प्रमाणीकरण तथा अनुपयोग एवं अनुत्पादक भूमि के विष्लेशण ने चयनित जिलों में सतत झींगा पालन विकास हेतु संभावित क्षेत्रों की पहचान में सहायता की।

हाइपोक्सिया सहनषीलता तथा मिल्कफिष की जलवायु सहनषीलता

मिल्कफिष पर किए गए प्रायोगिक परीक्षणों से इसकी तीव्र हाइपोक्सिया सहनषीलता प्रदर्षित हुई, जिसमें घुलित ऑक्सीजन के तीव्र तथा क्रमिक दोनों प्रकार के ह्रास के अंतर्गत LC_{50} मान 0.5 ppm पाया गया। ये निश्कर्श जलवायु सहनषील जलीय कृशि हेतु मिल्कफिष की उपयुक्तता को रेखांकित करते हैं।

जलवायु परिवर्तन के प्रति खारे जल की जलीय कृशि का जोखिम आकलन

।त6दृप्च्ब्ब फ्रेमवर्क के आधार पर खारे जल की जलीय कृ–ि के लिए जोखिम तथा संवेदनेीलता मानचित्र तैयार किए गए। आकलित 51 तटीय जिलों में से 16 को उच्च से अत्यधिक उच्च जोखिम श्रेणी में रखा गया, जबकि 17 को निम्न से अत्यंत निम्न जोखित श्रेणी में वर्गीकरण किया गया। यह व्यवस्थित वर्गीकरण जिला स्तरीय जलवायु जोखिम प्रबंधन में सहायक हो सकता है।

झींगा फार्मों में *विब्रियो* पर भारी वर्शा का प्रभाव

दक्षिण गुजरात के झींगा तालाबों में भारी मानसूनी वर्शा ने जल गुणवत्ता को उल्लेखपनीय रूप से प्रभावित किया। मौसमी विष्लेशण से ग्रीश्म ऋतु की तुलना में मानसून के दौरान अमोनिया, मटमैलेपन में वृद्धि, क्षारीयता में परिवर्तन तथा *विब्रियो* भार मे वृद्धि पाई गई। जल गुणवत्ता के कुछ मापदंडों में तनुकरण के कारण अपेक्षित परिवर्तन के अतिरिक्त, मानसून के दौरान येलो कॉलोनियों की संख्या ग्रीश्म ऋतु की तुलना में उल्लेखनीय रूप से अधिक रही।

जलमग्न जलीय कृशि क्षेत्रों का भू–स्थानिक आकलन

सेंटिनल–2बी चित्रों तथा SRTM ऊंचाई आंकड़ों का उपयोग करते हुए दूरसंवेदी जीआईएस अध्ययन द्वारा दिसंबर, 2023 की बाढ़ के बाद आंध्र प्रदेेा के गुडूर में जलीय कृ–ि जलमग्नता के आकलन हेतु बाढ़ मानचित्रण तथा क्षति परिमाण ीकरण किया गया। कुल 5,255 हेक्टेयर जलीय कृ–ि क्षेत्र में से 3,346 हेक्टेयर क्षेत्र जलमग्न पाया गया, जिससे आपदा आकलन तथा जलवायु सहनेील योजना निर्माण के लिए एक तीव्र एवं विस्तारणीय दृ–िटकोण प्रदेीत हुआ।

संवर्धन तथा जलवायुवीय मानकों का उपयोग कर झींगा रोग पूर्वानुमान मॉडल

झींगा के दो प्रमुख रोगों, WSSV तथा EHP के लिए जलवायवीय तथा संवर्धन मानकों का उपयोग कर रोग पूर्वानुमान मॉडल विकसित किए गए। परीक्षण किए गए सात मषीन लर्निंग एल्गोरिद्म में रैंडम फॉरेस्ट तथा एक्सजीबूस्ट ने दोनों रोगों के लिए निरंतर उच्च पूर्वानुमान सटीकता प्रदर्षित की। जलवायु आंकड़ों के साथ संवर्धन मानकों के एकीकरण से मॉडल की सटीकता में सुधार हुआ।

श्रिम्पसिम (ShrimpSIM) : झींगा वृद्धि अनुकरण मॉडल

संवर्धन प्रणालियों में झींगा वृद्धि का पूर्वानुमान करने हेतु तंत्र गतिकी मॉडल विकसित किए गए। यह मॉडल मौसम

तथा संवर्धन मानकों जैसे इनपुट का उपयोग कर जैवभार, उत्तरजीविता दर, आहार उपयोग तथा नाइट्रोजन अपषिश्ट सहित अनुकरणित परिणाम उत्पन्न करता है। उपयोगकर्ता परिभाशित इनपुट मानकों के आधार पर मॉडल चलाने हेतु श्रिम्पसिम नामक एक ऑनलाइन वेब उपकरण विकसित किया गया।

पीनियस वन्नामेय में श्रिम्प आंत्र सूक्ष्मजीव समुदाय पर कार्यात्मक आहार का प्रभाव

निम्न, इश्टतम तथा उच्च लवणता स्थितियों में *पीनियस वन्नामेय* के आंत्र सूक्ष्मजीव समुदाय पर किण्वित पादप प्रोटीन आहार के प्रभावों से बढ़ती लवणता के साथ *प्रोटीओबैक्टीरिया* की प्रचुरता में वृद्धि पाई गई। उच्च लवणता स्थितियों में 7.5 प्रतिषत किण्वित आहार प्रापत झींगा में *सेराटिया* स्ट्रेन प्रमुख रहे, जो पाचन, सूक्ष्मजीवी संतुलन तथा प्रतिरक्षा विनियमन हेतु संभावित प्रोबायोटिक लाभ दर्षाते हैं।

SIPNSF प्रणाली में ग्रीन हाउस गैस सूचीकरण

SIPNSF प्रौद्योगिकी का 175 तथा 350 संख्या प्रति घनमीटर की दो संचयन घनत्वों पर ग्रीनहाउस गैस उत्सर्जन के लिए मूल्यांकन किया गया। मीथेन तथा नाइट्रस ऑक्साइड उत्सर्जन का परिमाण ीकरण किया गया तथा औसत वैष्विक तापवर्धन क्षमता (0.9–1.1 g CO_2 eq./कि.ग्रा. श्रिम्प) पारंपरिक कच्चे तालाब प्रण ालियों की तुलना में उल्लेखनीय रूप से कम पाई गई, जिससे उन्नत पर्यावरणीय स्थिरता प्रदर्षित हुई।

किण्वित आहार तथा लवणता का ग्रीनहाउस गैस उत्सर्जन पर प्रभाव

लवणता स्ट्रैस कम करने हेतु निर्मित किण्वित पादप प्रोटीन आहार का *पीनियस वन्नामेय* में ग्रीनहाउस गैस उत्सर्जन पर प्रभाव आंकलन किया गया। 7.5 प्रतिषत किण्वित आहार देने से विभिन्न लवणता स्तरों पर नाइट्रस ऑक्साइड उत्सर्जन में उल्लेखनीय कमी आई, जिससे नाइट्रोजन उपयोग दक्षता में सुधार का संकेत मिला। मिथेन और कार्बनडाइऑक्साइड उत्सर्जन अप्रभावित रहे, जो जलवायु स्मार्ट तथा पर्यावरणीय रूप से सतत झींगा जलीय कृशि का समर्थन करते हैं।

ग्रीन हाउस गैस षमन से संबंधित जीवाण ुओं की वंषानुक्रमिक विविधता

16S rRNA जीन अनुक्रमण पर आधारित खारे जल तलछटों से प्राप्त मीथेन उपजीवी तथा संबद्ध जीवाणुओं के वंषानुक्रमिक विष्लेशण से छह वंष – *मेथिलोबैसिलस, मेथिलोफागा, मेथिलोवर्सेटिलिस, स्यूडोजैंथोमोनास, स्यूडोमोनास* तथा *मेथिलारूब्रम* की पहचान की हुई। ये निश्कर्श तटीय जलीय कृशि पारितंत्रों में जैविक ग्रीनहाउस गैस षमन हेतु इन जीवाणु समुदायों की संभावनाओं को रेखांकित करते हैं।

सीबामॉक्स (CIBAMMOX) का प्रभाव

सीबामॉक्स (CIBAMOX) के अंगीकरण से नाइट्राइट (77.7 प्रतिषत) तथा TAN (64.6%), में उल्लेखनीय कमी आई, झींगा फार्मों में जीवित रहने की दर, एफसीआर तथा जैवभार में वृद्धि हुई तथा लाभप्रदता में सुधार हुआ (लाभ–लागत अनुपात : 1.22; निवेष प्रतिफल : 39.3 प्रतिषत)।

झींगा आपूर्ति श्रंखला के लिए ब्लॉकचेन–आधारित प्वज ट्रेसेबिलिटी सिस्टम

झींगा आपूर्ति श्रंखला प्रबंधन के लिए, फीडबैक सिस्टम के साथ QR कोड और ब्लॉकचेन पर आधारित IoT ट्रेसेबिलिटी सिस्टम का एक प्रोटोटाइप डिजाइन कर लागू किया गया। यह एक ओपन प्लाटफार्म है जिसे किसी भी मछली और मछली से बने उत्पादों के लिए कस्टमाइज किया जा सकता है और इसे 'मत्स्य पालन और जलीय कृषि में ट्रेसेबिलिटी पर राष्ट्रीय फ्रेमवर्क–2025 में शामिल किया गया है।

तटीय मात्स्यिकी तथा जलीय कृशि में महिला सषक्तीकरण

तटीय तमिलनाडु में मात्स्यिकी, सजावटी मछली पालन, केकड़ा पालन तथा विपण ान में महिलाओं की महत्वपूर्ण भूमिका को रेखांकित किया गया। लैंगिक विषिश्ट आजीविका अवसरों, बाधाओं तथा पर्यावरणीय परिवर्तनों के प्रति अनुकूलन का अध्ययन कर महिलाओं के आर्थिक सषक्तीकरण को सुदृढ़ करने तथा लैंगिक समावेषी, सहनषील तटीय विकास को बढ़ावा देने हेतु अंतर्दृश्टियां प्राप्त की गईं।

पष्चिमी तट पर उच्च घनत्व व्हाइटलेग श्रिम्प पालन का निरूपण

92 दिनों के अंत में 117 तथा 134 संख्या प्रति वर्गमीटर के उच्च घनत्व पर पालित *पीनियस वन्नामेय* से क्रमषः 825 वर्गमीटर तथा 700 वर्गमीटर तालाबों से क्रमषः 1562 किलोग्राम तथा 1525 किलोग्राम उत्पादन प्राप्त हुआ, जिससे 19 से 22 टन प्रति हेक्टेयर प्रति फसल उत्पादकता प्राप्त हुई।

अनुसूचित जाति समुदायों हेतु आजीविका गतिविधि के रूप में त्रि–स्तरीय सीबास पालन

तमिलनाडु के कोवलम तथा मठमपट्टिनम गांवों में 150 तटीय अनुसूचित जाति लाभार्थियों के बीच त्रि–स्तरीय सीबास पालन मॉडल का निरूपण किया गया। 40,000 संचयित बीजों से 37,000 अंगुलिकाओं का उत्पादन हुआ, जिससे 14 लाख रूपये का राजस्व प्राप्त हुआ तथा समुदायों में तकनीकी कौषल, आजीविका अवसरों तथा आत्मनिर्भरता में वृद्धि हुई।

मक्का तथा आलू हेतु उर्वरक के रूप में प्लैंकटन$^{प्लस}$

मक्का तथा आलू में प्रक्षेत्र अध्ययन के अंतर्गत 100 प्रतिषत तथा 75 प्रतिषत अनुषंसित उर्वरक मात्रा के साथ प्लैंकटन$^{प्लस}$ (PP) की चार खुराकों का मूल्यांकन किया गया। सर्वाधिक उपज मक्का में 05 प्रतिषत प्लैंकटन$^{प्लस}$ + 100 प्रतिषत अनुषंसित उर्वरक मात्रा तथा आलू में 06 प्रतिषत प्लैंकटन$^{प्लस}$ + 100 प्रतिषत अनुषंसित उर्वरक मात्रा से प्राप्त हुई। 75 प्रतिषत अनुषंसित उर्वरक मात्रा के अंतर्गत मक्का तथा आलू में क्रमषः 05 प्रतिषत तथा 06 प्रतिषत प्लैंकटन$^{प्लस}$ के साथ उपज में 27 प्रतिषत तथा 13.8 प्रतिषत वृद्धि हुई।

Executive summary

Nursery rearing of Pacific white shrimp in an indoor tank system

Two indoor nursery trials of *Penaeus vannamei* in 50-tonne tanks at Navsari, Gujarat, demonstrated the effectiveness of nursery rearing. Stocking at 2,500 PL/m³ resulted in 87–100% survival and 0.045 g mean weight in 32 days. Extended rearing for 50 days produced 0.25 g juveniles, highlighting the system's potential for healthy seed production.

Production performance of Pacific white shrimp in high-density HDPE-lined ponds

Penaeus vannamei juveniles of 0.24 g were stocked at densities of 134 and 117 shrimp/m² in modified HDPE geomembrane-lined ponds, achieving productivities of 1.89 and 2.20 kg/m², equivalent to 18.93 and 22.0 tonnes/ha/crop, respectively, highlighting the high production potential of the system.

Effects of stocking density on gut microbiota dynamics in Pacific white shrimp cultured in SIPNSF system

High-density culture (380 shrimp/m³) resulted in higher microbial turnover, greater diversity dispersion, and increased *Vibrio* abundance, indicating reduced stability and risk of dysbiosis. Low-density shrimp (190 shrimp/m³) maintained a more stable and consistent microbial community restructuring.

Comparative performance of Indian white shrimp and Pacific white shrimp in a biofloc-based super-intensive rearing system

A 90-day biofloc culture study involving *Penaeus vannamei* and *Penaeus indicus* demonstrated that the integrated system combining CIBAFLOC and periphytic substrates achieved the highest growth, with final

weight gains of 19.56 g and 18.76 g, respectively. Improved digestive, metabolic, antioxidant, and immune responses underscored its potential for sustainable shrimp production.

Performance of tiger shrimp in different stocking densities in a natural feed-based precision intensive farming system

A 142-day grow-out trial of *Penaeus monodon* under semi-floc conditions showed that lower stocking density (30 shrimp/m³) yielded superior growth (38.4 g), survival (98%), and feed efficiency (FCR 1.58), while higher density (100 shrimp/m³) achieved maximum biomass production (788.9 kg). The results highlight the trade-off between individual performance and total yield in sustainable shrimp farming.

Study on the effect of fermented microbial consortium in a biofloc culture system

A 45-day feeding trial demonstrated that microbial consortium-fermented biofloc significantly enhanced the growth, survival, immunity, and digestive gene expression of *Penaeus vannamei*. Shrimp in the fermented biofloc treatment achieved the highest weight gain (9.70 g) and survival (97.2%), indicating its potential as an effective strategy for improving shrimp health and production performance.

Production of iron and selenium-enriched biofloc using chelated minerals

A pilot study demonstrated the feasibility of producing iron- and selenium-enriched biofloc using selected bacterial isolates and chelated trace minerals. The enriched bioflocs effectively assimilated and retained minerals, supported beneficial microbial and rotifer populations, and improved nutrient recycling, highlighting their potential to enhance the nutritional quality and sustainability of biofloc-based aquaculture systems.

Evaluation of nursery performance of Pacific white shrimp using a zinc-enriched biofloc microbial consortium

A 45-day biofloc trial demonstrated that zinc supplementation (20 ppm $ZnSO_4$) significantly enhanced growth, survival, zinc assimilation, and antimicrobial peptide gene expression in *Penaeus vannamei* post-larvae. Zinc-fortified biofloc increased body weight by 37%, specific growth rate by 21%, and reduced feed conversion ratio by 22%, indicating improved productivity, health, and disease resistance.

Comparison of multi-species culture of seabass, pearlspot, milkfish, and shrimp in a cage-cum-pond system

A 45-day multi-species aquaculture trial integrating cage-cultured seabass and pearlspot with pond-reared milkfish and tiger shrimp demonstrated efficient resource utilization and satisfactory growth, survival, and water quality. Milkfish effectively utilized natural productivity, while tiger shrimp showed rapid growth. The integrated cage-cum-pond system offers a productive, sustainable, and economically viable aquaculture strategy.

Asian seabass trial in inland saline areas of Punjab

A total of 1,000 hatchery-produced seabass fingerlings (16–40 g) were stocked initially in RAS, earthen ponds, and temperature-controlled polyhouses for winter culture. Fed with Seabass Growout^{Plus} feed, the fish attained an ABW of 580 g within eight months, demonstrating the feasibility of seabass farming in inland saline areas.

Optimization of stocking density for pond-based cage culture of Asian seabass

A 180-day grow-out trial of Asian seabass in pond-based net cages demonstrated that lower stocking densities (30–40 fish/m³) achieved significantly better growth, survival, and production performance than 50 fish/m³. The study identified 40 fish/m³ as the optimal stocking density, providing a practical and profitable culture strategy for community-based aquaculture initiatives.

Seaweed diversity and seasonal dynamics

Significant spatial and seasonal variations in seaweed biodiversity were observed across 22 brackishwater sites in Tamil Nadu, with Muttukadu Lagoon and Kalpakkam identified as biodiversity hotspots.

Seaweed-integrated nursery rearing of Indian white shrimp

A 45-day co-culture trial of *Penaeus indicus* with *Gracilaria* seaweed significantly enhanced shrimp growth and crude protein content up to 63.56%. *G. corticata* achieved a higher specific growth rate of 1.4% compared to 0.97% in *G. foliifera*, making it a more effective species for improving shrimp nursery performance than monoculture.

Optimizing *Caulerpa racemosa* density for integrated shrimp culture

Seaweed growth declined significantly with increasing stocking density. A stocking density of 1 kg/m² achieved a higher specific growth rate of 2.47% compared to 1.16% at 2 kg/m², indicating that lower stocking density is optimal for pond-based raft culture systems.

Seaweed-integrated shrimp farming (SISF) system

Seaweed-integrated shrimp farming (SISF) using *Gracilaria*

salicornia with *P. vannamei* in lined ponds improved shrimp growth, yield, and feed efficiency. Shrimp attained a higher ABW of 23.2 g and 9.1 t/ha yield with an FCR of 1.36. Improved water quality and 12 t/ha seaweed production highlighted the ecological and economic benefits of the system.

Standardization of electro-extrusion for spermatophore collection

Electro-extrusion was standardized as a safe, non-lethal, and repeatable technique for collecting spermatophores from male *Penaeus indicus*. The optimized voltage, tailored to shrimp size, enabled 100% spermatophore extrusion without injury while allowing regeneration. This protocol enhances broodstock management, supports repeated collection, and improves the efficiency of controlled breeding and hatchery seed production.

Reproductive potential of kuruma shrimp

A total of 186 wild *Penaeus japonicus* brooders collected from the Chennai coast exhibited a male-biased sex ratio of 2.7:1, with an average body weight of 35.36 g (22–49 g) in males and 70 g (43–98 g) in females. Successful captive maturation and spawning was achieved, and salinity tolerance studies revealed better growth performance in 40 ppt salinity.

Optimized feeding protocol for blue swimmer crab from megalopa to first crab instar

Seven feeding protocols were evaluated to optimize the rearing of *Portunus reticulatus* from megalopa to first crab instar. Co-feeding strategies outperformed single diets, with the combination of *Artemia* and formulated feed achieving the highest survival and conversion efficiency, making it the most effective larval feeding protocol.

Captive breeding of orange mud crab

Broodstock maturation and breeding of *Scylla olivacea* were successfully achieved at the Kakdwip Research Centre of ICAR-CIBA. Wild females maintained under controlled conditions in the indoor maturation system spawned successfully after eyestalk ablation, producing 1-5 million eggs per female with hatching rates ranging from 70% to 78%.

Larval rearing of porcelain crab

Successful hatching and initial larval rearing of *Neopetrolisthes maculatus* were achieved at 28 ppt salinity and 28 ± 1°C. Larvae developed to the Zoea II stage within six days. Beyond 15 days, mortality was high due to poor feeding efficiency. Further, optimized feeding protocols and water quality management are required for completing the larval cycle.

Hideout substrates for green mud crab nursery rearing

Five hideout substrates were evaluated for nursery rearing of *Scylla serrata* from megalopa to crab instar. All substrates significantly improved survival compared to the control by reducing cannibalism. Broken tiles, clam shells, and coconut leaves were most effective, while growth remained similar across treatments.

IoT-based automated live feed system for crab hatchery management

An IoT-based Automated Live Feed System was developed for crab hatcheries to enable precise, automated feed delivery and real-time monitoring. The system reduced labour dependency, improved feeding accuracy, and supported uniform larval growth and survival. Its adaptable and scalable design enhances hatchery efficiency, sustainability, and reliable crab seed production.

Hormone-induced precocious maturation in Asian seabass broodstock

Hormone-assisted precocious maturation of protandrous Asian seabass broodstock using sustained-release GnRH analogue with 17α-methyltestosterone or 17β-estradiol successfully induced milting and advanced ovarian development. Six spawning events produced 5,00,000 eggs with fertilization and larval survival rates comparable to those obtained from conventional large broodstock.

Captive maturation of Asian seabass broodstock exclusively fed with CIBA-formulated feed

Newly recruited Asian seabass sub-adults were reared as broodstock in an earthen pond and fed with a ICAR-CIBA-formulated broodstock diet. Both males and females attained maturity in December, marking the first successful captive maturation of Asian seabass broodstock exclusively fed with CIBA-formulated feed.

Milkfish broodstock continuous maturation and seed production

Milkfish broodstock maintained in RCC tanks and environment-controlled RAS exhibited continuous maturation following monthly hormone implantation. Six successful spawnings produced 45,500 fry, which were distributed to stakeholders across Tamil Nadu, Gujarat, Odisha, Assam, and West Bengal.

Scaling up the breeding of mangrove red snapper for mass seed production

Captive breeding of mangrove red snapper *(Lutjanus argentimaculatus)* was standardized through seasonal broodstock maturation studies and induced breeding trials. Gonadal development, sperm quality, spawning performance,

fertilization, hatching, and larval rearing protocols were established. Successful spawning yielded 3.51 lakh eggs with 70% fertilization and 75% hatching rates.

Induced breeding of captive gold-lined seabream

Broodstock development of gold-lined seabream, *Rhabdosargus sarba,* was undertaken through captive rearing and conditioning of juvenile and wild brooders. Gonadal maturation was achieved in 80% of broodstock, and induced breeding trials were conducted using HCG. Although spawning was not achieved, reproductive readiness was confirmed, guiding future breeding interventions.

Broodstock collection and gonadal maturity assessment of the streaked spinefoot

Broodstock development of streaked spinefoot, *Siganus javus,* was strengthened through captive rearing, reproductive monitoring, and hormonal interventions. Seasonal gonadal maturation patterns, sex ratio, and length at first maturity were established. LHRHa hormone pellet implantation significantly enhanced oocyte growth, demonstrating its potential for accelerating broodstock maturation.

Closing the life cycle of mangrove pipefish

Broodstock management and larval rearing protocols were standardized for the mangrove pipefish (*Ichthyocampus carce*), enabling successful captive breeding and juvenile production. Optimized environmental conditions and stage-specific feeding regimes improved larval survival and metamorphosis.

Captive breeding of green puffer fish

Green puffer fish, *Tetraodon fluviatilis* broodstock were successfully acclimatized and induced to spawn using LHRHa, producing 50,000 - 1,20,000 eggs per female with 72 hours latency period. Initial larval rearing studies using live and formulated feeds achieved a survival rate of 20%.

Captive maturation of hilsa in earthen ponds

More than 80% of hilsa captive stock, including both males and females, attained maturity in a brackishwater pond system. Female oocyte diameters ranged from 551 to 684 µm, while males exhibited a sperm motility score of 3, sperm activity of 2-3 minutes, and a density of 5.38 × 10^9 cells.

Rice DDGS as an alternative protein source in shrimp feed

Rice DDGS was evaluated as a replacement for soybean meal in diets of *Penaeus vannamei* at inclusion levels of 0, 10, 20, and 30%. No significant differences were observed in growth performance, health status, or histopathological parameters, indicating its potential as an alternative protein source for shrimp feed formulation.

Golden and purple sweet potato meal as energy and functional feed ingredients

Nutritional evaluation trials revealed that golden and purple sweet potato meals are rich in available carbohydrates and suitable as alternative energy sources in fish diets. Replacing 33% of wheat with sweet potato meal enhanced fish coloration, demonstrating its potential as a functional feed ingredient in enhancing pigmentation in ornamental fishes.

Optimisation of dietary protein requirement for tiger goby

A feeding trial evaluated diets containing 25, 30, 35, 40 and 45% crude protein to determine the dietary protein requirement of tiger goby, *Mugilogobius tigrinus*. Dietary protein levels of 35-40% supported optimal growth, providing a basis for the development of nutritionally balanced feeds for aquaculture production.

Cottonseed meal inclusion on growth-related gene expression and gut microbiota in whiteleg shrimp

Dietary inclusion of cottonseed meal (CSM) influenced growth- and metabolism-related gene expression in *Penaeus vannamei*. Increasing CSM levels significantly downregulated IGF-II, PM, PFK, and FAS genes, while shrimp fed diets containing 0% (CS0) and 15% (CS15) CSM maintained higher intestinal microbial diversity and community stability.

Dietary inclusion of fermented sunflower oilcake on growth, immunity, and gut microbiome of whiteleg shrimp

Fermentation of sunflower oilcake improved its nutritional quality by increasing crude protein and essential amino acid contents while reducing fibre and antinutritional factors, including tannins and saponins.

Optimization of dietary protein requirement for juvenile blue swimmer crab

Dietary protein requirements of juvenile blue swimmer crab were evaluated over 90 days. Crabs fed with a 40% protein diet exhibited better growth performance and feed utilization. Increasing dietary protein beyond 40% did not improve growth performance significantly, indicating 40% is the optimum protein required in the diet for crab grow-out culture

Beneficial modulation of shrimp gut microbiota using Plankton^{Plus} and Chingudi^{Plus} feed

Chingudi^{Plus} feed fed shrimp with supplementation of Plankton^{Plus} significantly increased the

relative abundance of beneficial *Lactococcus* species while reducing the abundance of potentially pathogenic *Vibrio* species, indicating improved gut microbial health.

DHA-rich thraustochytrid for larval nutrition

The DHA-rich thraustochytrid *Aurantiochytrium acetophyllum*, isolated from Pichavaram mangroves, was optimized for growth at 25 ppt salinity, yielding high biomass with 43.71% lipid and 37.77% protein. *Artemia* enriched with live *A. aceptoplyllum* achieved the highest growth of 90.3 mg and 97.77% survival, demonstrating its potential as a superior larval feed enrichment.

Surveillance of major shrimp diseases in India

A surveillance study of 152 shrimp farms for WHOA-listed diseases across India revealed the continued predominance of white spot disease (19%) and EHP infection (10.5%). The findings highlight the persistent disease burden in shrimp aquaculture and underscore the need for improved diagnostics, biosecurity, and integrated disease management strategies.

Dose-dependent immune modulation in WSSV-infected shrimp

Experimental infection of *P. vannamei* with different WSSV doses revealed a clear dose-dependent immune response. Higher viral dose of 10^2 copies triggered rapid viral replication, significant haemocyte depletion, and peak IL-16 expression at 7 days post-infection, whereas lower doses caused delayed disease progression, demonstrating a clear relationship between viral load and disease severity.

Impact of running mortality syndrome in shrimp farms

A systematic survey of running mortality syndrome in Nagapattinam District, Tamil Nadu, revealed a prevalence of up to 60%. The disease caused substantial production losses of 1.85 tonnes/ha and an estimated revenue loss of ₹0.84 million per hectare, highlighting its significant economic impact.

Health assessment of diseased mud crabs

Diseased mud crab, *Scylla serrata,* samples collected from Tamil Nadu and Kerala were free from mud crab reovirus, WSSV, EHP, and parasitic infestations. However, bacterial infections caused by *Vibrio alginolyticus*, *Marinobacter nauticus*, and *Aeromonas spp*. were detected, along with other opportunistic environmental vibrios.

Monogenean gill parasite in Asian seabass

The monogenean gill parasite, *Dolicirroplectanum penangi,* was identified in Asian seabass with 100% prevalence, resulting in daily mortalities of 2–3 fish in infected fish tanks and recirculatory aquaculture systems. Fish harboured an average of 42.91 ± 19.37 parasites per fish, causing severe stress and pathological manifestations in gills.

Establishment of an Asian seabass muscle cell line

An Asian seabass muscle cell line was established with 175 passages. Molecular characterization of the cell line confirmed its origin. Upon induction with differentiation medium, myoblasts developed into myotubes and myofibrils. The cell population exhibited a doubling time of 21 hours and 19 minutes, indicating robust growth.

Rapid CRISPR-based detection of WSSV and EHP

State-of-the-art gene editing technologies were developed for rapid detection of WSSV and EHP in resource-limited settings. A simple filter paper-based nucleic acid extraction method enabled instrument-free sample processing. WSSV was detected using a one-pot RPA–CRISPR/Cas12a assay, while EHP was identified within 20 minutes using an RPA-based diagnostic approach.

Triplex quantitative real-time PCR for *Vibrio spp.*

A highly sensitive and specific quantitative real-time PCR assay was developed for rapid detection and quantification of *Vibrio parahaemolyticus, V. harveyi,* and *V. campbellii* using novel pangenome-derived marker genes. The assay demonstrated 100% sensitivity and specificity against aquatic pathogens, providing a reliable tool for early diagnosis and surveillance of vibriosis in aquaculture.

Multiplex LAMP assay for the simultaneous detection of WSSV and EHP

A multiplex LAMP-based lateral flow assay was developed for the simultaneous detection of WSSV and EHP. The assay detected as few as 10 target copies within 55 minutes and achieved 100% diagnostic sensitivity and specificity, providing a simple point-of-care tool for routine farm-level surveillance.

Efficacy of CIBA EHP Cura Gro^{Plus}

CIBA EHP Cura Gro^{Plus} was validated in 104 shrimp farms across five states, significantly reducing EHP and *Vibrio* loads and controlling white faeces syndrome in 75% of farms. The product demonstrated stability for one year, and improved survival from 67% to 80%, FCR from 1.71 to 1.37, and production by 62%.

Nationwide dissemination of CIBA EHP Cura Gro^{Plus}

Nationwide outreach programmes were organized in collaboration with NFDB

to promote the adoption of CIBA EHP Cura Gro^{Plus}. More than 600 farmers participated, regional extension booklets were released, and demonstration quantities were distributed to support large-scale field adoption and awareness.

Microalgae-based vaccine for viral nervous necrosis

Recombinant plasmids carrying a codon-optimized NNV capsid protein gene were successfully transformed into *Chlamydomonas reinhardtii* through electroporation. The presence of the insert in the recombinant colonies was verified, and the resulting NNV capsid protein-expressing clones have potential as oral or immersion vaccines to protect finfish larvae against Viral Nervous Necrosis.

Control of seaweed epiphytes

Gracilaria corticata infested with the epiphyte *Colaconema sp*. was treated using povidone-iodine at different concentrations (0.05% to 2%) and duration (30s, 1min, and 3m). Image-based chlorophyll bleaching analysis confirmed that 1 to 2% povidone-iodine for 3 minutes achieved >90% efficacy within 48 hours, providing an effective mitigation strategy.

IoT based traceability system for shrimp supply chain management

Design and implementation of IoT with block chain-based traceability system for shrimp supply chain management, is a prototype developed and field tested for shrimp end to end value chain with feedback mechanism. This QR code-based system is open platform and amenable for customization to any fish and fishery products.

Comparative genomic analysis of *Vibrio harveyi* and *V. parahaemolyticus*

Genomic analysis of 216 *Vibrio harveyi* genomes revealed a highly conserved genome with ~80% core genes and key virulence determinants, including type II, III, and V secretion systems. *V. parahaemolyticus* F10G1, isolated from white faeces syndrome, possessed a 5.37 Mb genome, and harboured multiple virulence-associated elements, highlighting its pathogenic potential in shrimp.

ShEnrich: A Penaeid shrimp-specific annotation and enrichment analysis platform

ShEnrich is a functional annotation and enrichment platform for Penaeid shrimp. The platform enables comparative genomics and enrichment workflows, addressing the lack of robust annotation tools for crustaceans.

SSR marker database for shrimp

An SSR marker database with 44 million markers has been built by predicting SSRs in the genome assembly of *Penaeus indicus*, *Penaeus japonicus*, *Penaeus vannamei*, *Penaeus chinensis*, and *Penaeus monodon*.

PIT tagging for shrimp

The utility of PIT tagging for individual identification has been standardized in shrimp by placing the tag in the tail muscle. This has applications to genetic improvement programs.

Multiplex SSR marker panels for Indian white shrimp

Six multiplex SSR marker panels comprising 24 markers have been developed for potential utility in genetic improvement programs.

Gut microbial profiles under salinity stress and feeding regimes in shrimp

A fall in gut microbial diversity was observed under high salinity, while high lipid diets increase it in *P. indicus*. These microbial communities regulate energy homeostasis and fatty acid biosynthesis, demonstrating that functional high-lipid feeds help shrimp mitigate hypersaline stress by modulating their intestinal microbiome.

Variation among WSSV isolates

Comparative genomics analyses of WSSV infected *Penaeus indicus* shrimp samples based on specific genome regions revealed the presence of Chinese, Australian, Indian, and Ecuadorian isolates.

Temperature-dependent transcriptional changes in WSSV-infected Indian white shrimp

The comparative Gene Set Enrichment Analysis of WSSV-infected *P. indicus* under different temperatures 27°C, 30°C and 33°C at 12, 24, and 48 hpi revealed varied gene expression levels at different conditions. Highly enriched pathways, including chitin-based cuticle development were observed in response to heat and protein refolding, particularly at 30°C and 33°C during 24–48 hpi.

Gut microbiota disruption in WSSV-infected wild Indian white shrimp

The WSSV infected shrimp showed a marked dominance of *Photobacterium* when compared to negative shrimp, where beneficial bacteria like *Enhydrobacter*, *Acinetobacter*, *Dialister,* and *Bifidobacterium* was predominant. The loss of commensals and expansion of pathogens indicated microbial dysbiosis caused by viral infection.

Variance-based microbial network analysis for amplicon sequence data

A novel slope-based, signed regression approach was used to analyze amplicon sequence data. Directional ecological interactions among microbes,

rather than the conventional abundance-based metrics were inferred and demonstrated that microbial interaction plasticity is a sensitive indicator of microbiome disruption.

Pan-genome analysis of probiotic and halo-tolerant bacteria

Pan-genomic analysis of 189 halo-tolerant *Bacillus* strains identified an open pan-genome featuring probiotic features, virulence factors, and anti-microbial genes. The study highlights ten *B. amyloliquefaciens* strains as the candidate probiotic species as they lack AMRs and virulence factors.

Chromosome-scale genome assembly for Asian seabass

The genome of Asian seabass has been deciphered which has a length of 614.9 Mb, an N50 length of 26.45 Mb, assessed to be 98.9% complete and predicted to contain 30,014 protein-encoding genes.

Chromosome-scale genome assembly of long whiskers catfish

Chromosome level genome of 706.32 Mb length in 108 scaffolds with N50 length of 22.79 Mb and full-length transcriptome of long whiskers catfish, *Mystus gulio* were generated. The finished assembly consisted of 29 chromosome-scale scaffolds. The transcriptome data was integrally used to predict 23,339 protein encoding genes.

Chromosome-level genome assembly for spinefoot rabbit fish

A chromosome-level genome assembly with a length of 583.1 Mb and an N50 metric of 25.71 Mb in 36 scaffolds was generated for rabbit fish. The assembly has 99.15% BUSCO completeness with 29,902 protein encoding genes.

Improved growth performance in pearlspot through mass selection

The F2 population showed 12%, 15.2%, and 16.5% superiority at six, eight, and nine months, respectively for body weight.

Synthesis and validation of single-guide RNAs for gene editing

Single guide RNAs (sgRNAs) targeting myostatin *(mstn)* in Asian seabass and pearlspot were synthesized and validated for cutting efficiency using the T7 Endonuclease I (T7E1) assay. Electroporation conditions were optimized and validated through the successful uptake of the fluorescent dye Lucifer Yellow in treated eggs.

Characterisation of source water and soil in inland saline areas

Surveys in the inland saline areas of Haryana and Rajasthan revealed mineral deficiencies in soil and water, alongside persistently high sulfate concentrations in groundwater and culture systems. The findings indicate that mineral supplementation and alkalinity correction are essential for sustainable shrimp farming in these regions.

Rejuvenation of aged shrimp culture ponds

The organic amendments: humus, vermicompost, and farmyard manure improved the available nutrients and microbial activity in aged shrimp culture ponds. Humus was found to be more effective, followed by vermicompost and farmyard manure, in enhancing soil fertility.

Nutrient dynamics in different aquaculture models of Sundarbans

Shrimp culture systems in South 24 Parganas, West Bengal, showed significant post-harvest nutrient accumulation and greater variability, while polyculture systems remained relatively stable.

Respiratory burst and apoptosis in whiteleg shrimp exposed to pH and ammonia stress

Penaeus vannamei were exposed to combinations of pH 7.5, 9.0, and 10.5 with ammonia levels of 3, 6, and 9 ppm as TAN. Analysis of haemolymph at 24, 48, and 96 hours by flow cytometry showed peak respiratory burst activity at 96 hours in pH 10.5/9 ppm ammonia, while apoptosis ranged from 14% to 62%.

Low-cost indigenous electrochemical pH sensor

Screen-printed carbon electrodes modified with polyaniline and graphene nanoparticles were fabricated for pH measurement in aquaculture ponds. The sensor exhibited a linear response over a pH range of 6–11, along with high stability and reliable performance in saline waters. Accuracy metrics and strong repeatability confirmed its suitability for real-time pH monitoring.

Copper porphyrin-based electrochemical nitrite sensor

A sensitive electrochemical nitrite sensor was developed using copper porphyrin-modified screen-printed carbon electrodes. Electrodeposition and surface activation enhanced catalytic performance, yielding excellent linearity over a wide concentration range. High reproducibility across multiple electrodes confirmed the sensor's reliability for real-time aquaculture water quality monitoring.

INTRODUCTION

Brackishwater aquaculture has emerged as one of the fastest-growing food production sectors, contributing significantly to food and nutritional security, livelihood generation, export earnings, and rural economic development. India possesses vast brackishwater and inland saline water resources, offering enormous potential for the expansion and diversification of aquaculture. ICAR–Central Institute of Brackishwater Aquaculture (ICAR-CIBA) continues to focus on strategic and applied research aimed at sustainable intensification, species diversification, aquatic animal health management, climate-smart aquaculture, feed and nutrition, genetic improvement, and environmentally responsible farming systems.

The Annual Report 2025 of ICAR-CIBA highlights the Institute's continued commitment to advancing sustainable, climate-resilient, and economically viable brackishwater aquaculture in India. Established in 1987 under the Indian Council of Agricultural Research (ICAR), the Institute has played a pivotal role in developing science-based technologies, providing policy support, and building capacities for the sustainable growth of the aquaculture sector.

During 2025, the Institute intensified its efforts to promote resilient aquaculture systems suited to Indian conditions, with a special focus on indigenous species such as Indian white shrimp and Asian seabass. Emphasis was placed on the development of farmer-friendly technologies, precision farming approaches, and digital advisory tools. The Institute also strengthened collaborations with national and international organizations, supported policy initiatives, and enhanced its outreach through training, extension activities, and stakeholder engagement.

This Annual Report presents the major research achievements, technology developments, institutional initiatives, infrastructure expansion, and extension activities undertaken by ICAR-CIBA during the year. It reflects the collective efforts of the Institute in supporting sustainable Blue Growth through science-led innovations for the benefit of farmers, entrepreneurs, and the aquaculture sector at large.

VISION

CIBA envisages its role as one of the world's foremost scientific research institute in brackishwater aquaculture through the pursuit of excellence in research and innovation that contribute modernization and development of sustainable brackishwater aquaculture in the country.

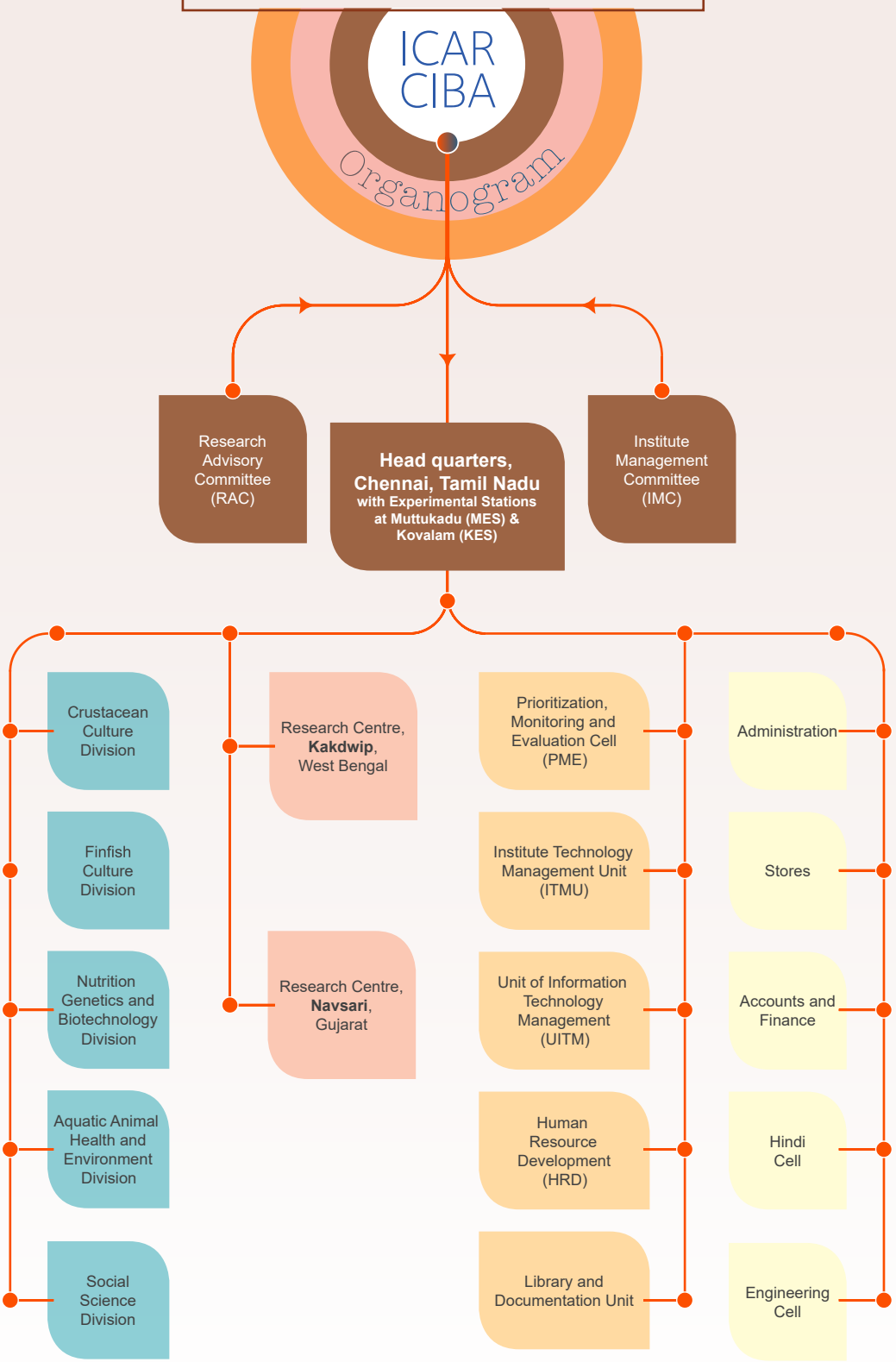
MISSION

Our mission is to realize this vision through basic and applied research, and providing technological backstopping suitable for Indian conditions for the development of sustainable brackishwater aquaculture, which would provide much needed food, nutritional security, employment, economic well-being and societal development.

MANDATE

- **Basic, strategic and applied research for techno-economically viable and sustainable culture systems for finfish and shellfish in brackishwater.**
- **Species and systems diversification in Brackishwater aquaculture.**
- **Act as a repository of information on brackishwater fishery resources with a systematic database.**
- **Human Resource Development, capacity building and skill development through training, education and extension.**

ORGANOGRAM


ICAR
CIBA
Organogram
Research Advisory Committee (RAC)
Head quarters, Chennai, Tamil Nadu
with Experimental Stations at Muttukadu (MES) & Kovalam (KES)
Institute Management Committee (IMC)
Crustacean Culture Division
Finfish Culture Division
Nutrition Genetics and Biotechnology Division
Aquatic Animal Health and Environment Division
Social Science Division
Research Centre, Kakdwip, West Bengal
Research Centre, Navsari, Gujarat
Prioritization, Monitoring and Evaluation Cell (PME)
Institute Technology Management Unit (ITMU)
Unit of Information Technology Management (UITM)
Human Resource Development (HRD)
Library and Documentation Unit
Administration
Stores
Accounts and Finance
Hindi Cell
Engineering Cell

Unified budget 2025

The Budget & Expenditure under
Non-Plan & Plan for the financial year 2025 of ICAR-CIBA

(₹ in lakhs)

Sl. No.	Head	RE 2025-26	Expenditure 1.4.2025 to 31.12.2025
Grants for creation of Capital Assets (Capital)			
1	Works - Office building	468.86	151.03
2	Equipments	50.56	50.56
3	Library Books and Journals	0.21	0.21
4	Vehicles & Vessels	28.74	15.98
5	Furniture & Fixtures	5.13	5.13
6	Others (TSP)	9.50	9.50
7	Others (SCSP)	22.00	22.00
	Total Capital	**585.00**	**254.41**
Grants in Aid – Salaries (Revenue)			
1	Salaries - Establishment charges	3104.00	2553.45
Grants in Aid - General (Revenue)			
1	Pension & Other Retirement Benefits	3060.00	2555.27
2	Traveling Allowance Domestic/Transfer	67.53	60.12
3	Research & Operational Expenses		
	A. Research Expenses	119.52	99.21
	B. Operational Expenses	256.02	196.09
	Total - Res. & Operational Exp.	375.54	295.30
4	Administrative Expenses		
	A. Infrastructure	302.78	236.73
	B. Communication	1.34	1.32
	C. Repairs & Maintenance		
	Equipments, Vehicles & others	55.02	44.35
	Office building	100.56	97.16
	Minor Works	152.78	124.67
	D. Others (excluding TA)	153.68	127.40
	Total - Administrative Expenses	766.16	631.63
5	Miscellaneous Expenses		
	A. HRD	7.59	6.78
	B. Publicity & exhibitions	12.95	12.55
	C. Guest House - Maintenance	3.23	2.62
	D. Other Miscellaneous (TSP)	155.00	143.04
	E. Others (SCSP)	277.00	259.97
	Total - Miscellaneous Expenses	455.77	424.96
	Total Revenue (Grants in Aid-Salaries + Grants in Aid-General)	7829.00	6520.73
	Grand Total (Capital + Revenue)	**8414.00**	**6775.14**

Revenue Generated (as on 31.12. 2025) : ₹196.70 lakhs

Cadre strength of ICAR-CIBA

Position	Sanctioned	Filled	Vacant
Director (R.M.P)	1	1	0
HOD	4	3	1
HoRs	1	1	0
Principal Scientist	2	0	2
Sr. Scientist	14	9	5
Scientist	52	49	3
Technical Officers/ Technical Assistant	31	14	17
Chief Administrative Officer	1	1	0
Senior Administrative Officer	1	0	1
Administrative Officer	1	1	0
CFAO/Dy. Director Finance	1	1	0
Senior Finance & Accounts Officer	1	0	1
Finance & Accounts Officer	0	1	-1
Assistant Finance & Accounts Officer	1	1	0
Assistant Administrative Officer	4	1	3
Principal Private Secretary	1	0	1
Private Secretary	2	1	1
Personal Assistant	3	2	1
Assistant	13	10	3
Upper Division Clerk (UDC)	5	2	3
Lower Division Clerk (LDC)	6	3	3
Skilled Support Staff (SSS)	30	8	22
TOTAL	**175**	**109**	**66**

Name of the Post	Sanctioned	Filled	Vacant
DIRECTOR (RMP)	1	1	0
SCIENTISTS (HOD/HORs/PS/Sr.Sci./Sci)	73	62	11
TECHNICAL	31	14	17
ADMINISTRATION	40	24	16
SSS	30	8	22
TOTAL	**175**	**109**	**66**

Research projects

Sl. No.	Project Code	Project Title	Principal Investigator
Crustacean Culture Division (CCD)			
Institute funded projects			
1.	FISHCIBASIL 202300200153	Amelioration of soil and water under different geographical regions for sustainable aquaculture production	Saraswathy R
2.	FISHCIBASIL 202300300154	Captive broodstock development and induced maturation techniques of kuruma shrimp, *Penaeus japonicus* Form II through hormonal / environmental & dietary approaches	Shyne Anand P
3.	FISHCIBASIL 202500100187	Development of brackishwater seaweed seedling production and its integration into crustacean farming systems	Aravind R
4.	FISHCIBASIL 202500200188	Technological standardization of seed production and rearing protocol for the commercialization of blue swimmer crab, *Portunus* sp.	Raymond Jani Angel J
Externally funded projects			
5.	FISHCIBASOL 202201000127	Demonstration of viable farming protocols for indigenous brackishwater seaweed species for income generation among coastal folks.	Nila Rekha P
6.	FISHCIBASOL 202200200119	Development of indigenous shrimp (Indian white shrimp) aquaculture: Genetic improvement Program of *Penaeus indicus*, Phase – I	Akshaya Panigrahi
7.	FISHCIBASOL 202300100133	Biofortification of trace elements in biofloc based aquaculture–microbial mediated approach for value added healthy shrimp and fish production	Akshaya Panigrahi
8.	FISHCIBASOL 202300200134	Development and demonstration of artificial intelligence based precision aquaculture technologies	Nila Rekha P
9.	FISHCIBASOL 202300800140	Evaluation and refinement of biofloc based new age farming technology through effective microbial management, recirculation and input optimization for sustainable intensification across different aquaculture system	Akshaya Panigrahi
10.	FISHCIBASOL 202400100141	Geospatial mapping of potential zones for expanding responsible aquaculture in Maharashtra	Jayanthi M

Sl. No.	Project Code	Project Title	Principal Investigator
Finfish Culture Division (FCD)			
Institute funded projects			
11.	FISHCIBASIL 202300400155	Upscaling the breeding and seed production of grey mullet (*Mugil cephalus*) and mangrove red snapper (*Lutjanus argentimaculatus*)	Kailasam M
12.	FISHCIBASIL 202300500156	Characterizing and developing the indigenous fish cell lines to prove stemness and proliferation in seafood cell culture	Makesh M
13.	FISHCIBASIL 202300600157	Application of assisted reproductive techniques in breeding programmes for *Lates calcarifer*	Sherly Tomy
14.	FISHCIBASIL 202300700158	Broodstock development and captive maturation of Streaked spine foot *Siganus javus* & *S. lineatus*	Jayakumar R
15.	FISHCIBASIL 202300900160	Development of base population for selective breeding on growth in pearlspot.	Sivamani B
16.	FISHCIBASIL 202301000161	Reliable seed production of brackishwater finfishes Seabass (*Lates calcarifer*), Milkfish (*Chanos chanos*) Mono angel (*Monodactylus argenteus*) and Scat (*Scatophagus argus*)	Subburaj R
17.	FISHCIBASIL 202500300189	Enriching live feeds with Thraustochytrids: a path to higher survival rates in brackishwater finfish and crab larvae	Sandeep K P
Externally funded projects			
18.	FISHCIBASOL 201800700099	Development of brackishwater aquariculture through optimisation of captive breeding protocols of potential and emerging ornamental fish species, technology transfer and livelihood generation	Kailasam M
19.	FISHCIBASOL 202501500152	Entrepreneurship and cluster farming model to empower coastal scheduled caste communities and increase productivity of value-chain of the high value fish Asian seabass *Lates calcarifer*	Kailasam M
20.	FISHCIBASOL 202201100128	Development of recombinant microalgae expressing Nervous necrosis virus capsid protein for vaccinating finfish against viral nervous necrosis (CRP on Vaccines and Diagnostics)	Makesh M
21.	FISHCIBASOL 202400300143	Genome editing approaches for improving growth and reproductive performance of Asian seabass (*Lates calcarifer*) and Indian white shrimp (*Penaeus indicus*)	Sherly Tomy
22.	FISHCIBASOL 202400500145	All India Network Project (AINP) on Ornamental fish breeding and culture	Dani Thomas
23.	FISHCIBASOL 202500400146	Unraveling the genetic variation among the Scat (*Scatophagus argus*) populations of India through captive breeding and molecular markers	Sandeep KP

Sl. No.	Project Code	Project Title	Principal Investigator
Aquatic Animal Health and Environment Division (AAHED)			
Institute funded projects			
24.	FISHCIBASIL 202301100162	Genotyping and virulence analysis of white spot syndrome virus	Shashi Shekhar M
25.	FISHCIBASIL 202301200163	Evaluation of stress mediated immunological and physiological response in brackishwater candidate species by flowcytometry	Shashi Shekhar M
26.	FISHCIBASIL 202301300164	Application of gene editing technologies (CRISPR/Cas) for disease diagnosis.	Poornima M
27.	FISHCIBASIL 202301400165	Interaction of *Enterocytozoon hepatopenaei* (EHP) and *Vibrio* spp. in disease outcome and their therapeutics	Ananda Raja R
28.	FISHCIBASIL 202301500166	Aquaculture pond ageing on soil, water quality and crop productivity in shrimp culture ponds	Kumararaja P
29.	FISHCIBASIL 202301600167	Fish diseases and their management with special reference to *Amyloodinium ocellatum* and other parasites.	Vidya Rajendran
30.	FISHCIBASIL 202301700168	Field evaluation of *Enterocytozoon hepatopenaei* (EHP) therapeutic CIBA EHP cura I	Sathish Kumar T
31.	FISHCIBASIL 202500600190	Design and implementation of IoT with block chain-based traceability system for shrimp supply chain management	Ananda Raja R
32.	FISHCIBASIL 202500600168	Investigation of running mortalities associated with white muscle (WMS) and white feces syndrome (WFS) in the shrimp farms of Nagapattinam	Sathish Kumar T
33.	FISHCIBASIL 202500500191	Disease prevalence in mud crabs, prevention and control of infectious diseases in culture systems	Bhuvaneswari T
Externally funded project			
34.	FISHCIBASOL 202200700124	National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) - 2. National Referral Laboratory for brackishwater fish diseases	Subhendu Kumar Otta
35.	FISHCIBASOL 201800400096	Indian Network for Fisheries and Animals Antimicrobial Resistance (INFAAR)	Subhendu Kumar Otta
36.	FISHCIBASOL 202000200105	All India Network Project (AINP) on Fish health	Patil PK
37.	FISHCIBASOL 202201400131	Development of molecular diagnostics for differentiation of pathogenic and non-pathogenic *Vibrio* species in aquaculture	Sujeet Kumar
38.	FISHCIBASOL 202200600123	National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) - 1. National surveillance programme for aquatic animal diseases in Tamil Nadu	Ezhil Praveena P
39.	FISHCIBACOP 201100100057	National Innovations in Climate Resilient Agriculture (NICRA) - Developing sustainable adaptive and mitigation strategies for climate smart brackishwater aquaculture	Muralidhar M

Sl. No.	Project Code	Project Title	Principal Investigator
40.	FISHCIBASOL 202201200129	Development of probiotics and immunostimulants for shrimp	Patil PK
41.	FISHCIBASOL 202201500132	Development of point of care diagnostics for the detection of major shrimp pathogens WSSV and EHP	Sathish Kumar T
42.	FISHCIBASOL 202200300120	Novel approaches for disease-free health certification in finfish and development of high health shrimp for sustainable aquaculture	Subhendu Kumar Otta
43.	FISHCIBASOL 202201300130	Development of microalgae based improved delivery method for control of shrimp White Spot Syndrome Virus (WSSV) in culture ponds	Subhendu Kumar Otta
44.	FISHCIBASOL 202300300135	Genome sequencing and its application for brackishwater aquaculture	Shashi Shekhar M
45.	FISHCIBASOL 202400400144	IoT based water and soil health monitoring systems with affordable indigenous sensors for intensive aquaculture	Muralidhar M
46.	FISHCIBASOL 202500700147	Awareness of better management practices for sustainable shrimp culture through CIBA technologies	Sathish Kumar T

Nutrition, Genetics & Biotechnology Division

Institute funded projects			
47.	FISHCIBASIL 202301800169	Identification and evaluation of diversified feed ingredients for their utility in shrimp and fish feeds for sustainability	Ambasankar K
48.	FISHCIBASIL 202301900170	Development, testing and demonstration of newer feeds and feed management strategies	Ambasankar K
49.	FISHCIBASIL 202302100172	Production and management of live feeds for use in aquaculture	Kumaraguru Vasagam KP
50.	FISHCIBASIL 202302200173	Molecular approaches for solutions directed towards the management of diseases and feed for aquaculture species	Vinaya Kumar Katneni
51.	FISHCIBASIL 202500800192	Optimization of nutrients and development of feed for grow-out culture of crabs	Anantharaja K
Externally funded projects			
52.	FISHCIBASOL 202000300106	Investigations on dietary alterations in shrimp for abiotic stresses using nutrigenomics approach	Ashok Kumar J
53.	FISHCIBASOL 202300600138	Atlas of climate adaptation in South Asian agriculture	Ashok Kumar J
54.	FISHCIBASOL 202000100104	Whole genome sequencing of brackishwater aquaculture candidate species and development of genomic resources	Vinaya Kumar Katneni
55.	FISHCIBASOL 202100400112	Solid state fermentation technology for development of cost-effective customized plant protein products as fishmeal alternate for shrimp feed	Syama Dayal J

Sl. No.	Project Code	Project Title	Principal Investigator
56.	FISHCIBASOL 202100500113	Unravelling signatures of growth and salinity adaptation in *Etroplus suratensis* through omics approaches	Vinaya Kumar Katneni
57.	FISHCIBASOL 202300400136	New age shrimp rearing system for precise use of land, water and feed	Kumaraguru Vasagam KP
58.	FISHCIBASOL 202300700139	Unravelling signatures of dietary protein sparing and fibre tolerance in *Penaeus vannamei* for development of cost-effective feeds through omics approaches	Syama Dayal J
59.	FISHCIBASOL 202500900147	Super-intensive precision and natural shrimp farming (SIPNSF) of NFDB	Kumaraguru Vasagam KP
60.	FISHCIBASOL 202500900148	Super-intensive precision and natural shrimp farming (SIPNSF) of MPEDA/RGCA	Kumaraguru Vasagam KP
61.	FISHCIBASOL 202500900149	Super-intensive precision and natural shrimp farming (SIPNSF) at TAHDCO	Kumaraguru Vasagam KP

Social Science Division

Institute Funded Projects			
62.	FISHCIBASIL 202302300174	Demonstrations of ICAR-CIBA nursery and grow-out technologies for livelihood upliftment and skill development of SC and tribal communities of coastal Odisha	Ravisankar T
63.	FISHCIBASIL 202302400175	Economic analysis in brackishwater aquaculture production marketing and trade sectors	Sairam CV
64.	FISHCIBASIL 202400600186	Livelihood analysis on gender participation in aquaculture sectors and impact of environmental changes and challenges faced by coastal families	Shanthi B
65.	FISHCIBASIL 202302600177	Brackishwater aquaculture led integrated livelihood development for the coastal SC families in Mayiladuthurai district of Tamil Nadu	Kumaran M
66.	FISHCIBASIL 202302700178	Diversification of farming activities for alternate sustainable livelihood of fisherfolk in Tamil Nadu and Karnataka	Geetha R
67.	FISHCIBASIL 202400200142	Front line demonstration on mud crab and blue swimmer crab in polyculture and monoculture systems	Mahalakshmi P
68.	FISHCIBASIL 202501200193	Development of innovative insurance models for aquaculture	Geetha R
Externally funded projects			
69.	FISHCIBASOL 202200500122	Production systems, agribusiness and institutions - component 1: Impact of agricultural technology	Geetha R

Sl. No.	Project Code	Project Title	Principal Investigator
Kakdwip Research Centre (KRC)			
Institute funded projects			
70.	FISHCIBASIL 202302800179	Demonstration and dissemination of brackishwater aquaculture technologies for livelihood development of SC and ST communities of Sundarban	Debasis De
71.	FISHCIBASIL 20230290180	Field validation and economic evaluation of effectiveness of Plankton Plus in agriculture, horticulture and aquaculture for livelihood improvement of SC and ST communities of India	Debasis De
72.	FISHCIBASIL 202303000181	Captive breeding and seed production of candidate brackishwater species of eastern region of India	Debasis De
73.	FISHCIBASIL 202303100182	Development and demonstration of sustainable and economically viable brackishwater aquaculture models for Eastern region of India	Sanjoy Das
Navsari Gujarat Research Centre (NGRC)			
Institute funded project			
74.	FISHCIBASIL 202303200183	Development of sustainable and cost-effective brackishwater farming technologies for shellfish and finfish in the western region	Akshaya Panigrahi
75.	FISHCIBASIL 202303300184	Demonstrations of brackishwater aquaculture technologies for livelihood upliftment and skill development of tribal communities of Western region	Pankaj Amrut Patil
76.	FISHCIBASIL 202303400185	Livelihood enhancement and skill development of SC communities in Gujarat through demonstration of brackishwater aquaculture technologies	Jose Antony
77.	FISHCIBASIL 202501400194	Assessment and utilization of seaweeds from Western region for introduction to brackishwater farming system	Pragyan Dash
Externally funded projects			
78.	FISHCIBASOL 202501500148	Mud crab box culture in aquaculture pond	Pankaj Amrut Patil

Divisional profiles

Divisional profiles

Crustacean Culture Division

The Crustacean Culture Division of CIBA stands as a pioneering hub dedicated to advancing sustainable brackishwater aquaculture for the India's most valuable and traded seafood commodity. Backed by nearly four decades of expertise, the division spearheads critical research and development designed to optimize production efficiency for currently farmed species while actively diversifying systems with novel candidates. Boasting sophisticated advanced wet laboratories, research hatcheries, and robust grow-out systems, a multi-disciplinary team of biologists, engineers, and biotechnologists collaborates nationally and internationally to translate cutting-edge scientific knowledge into refined, field-ready technologies. The division's modern focus includes transformative ecological initiatives, notably pioneering Seaweed-Integrated Shrimp Farming (SISF) systems to naturally improve water quality, and championing Responsible Aquaculture Zone Planning (RAZP) to establish sustainable spatial carrying capacities along India's coastlines.

Operationally, the division focuses its core research on overriding biological bottlenecks in captive maturation, larval rearing dynamics, growth physiology, and genomic stock improvement. A hallmark achievement includes initiating the construction of a state-of-the-art Nucleus Breeding Centre dedicated to the genetic improvement program for the Indian white shrimp (*Penaeus indicus*), delivering high-health, selectively bred lineages to domestic farmers. Furthermore, the division has driven species diversification through breakthroughs in seed production technologies for mud crabs, ornamental crabs, and blue swimmer crabs—advancements that have successfully catalysed the establishment of India's first generation of private crab hatcheries. By transitioning traditional farming models into modern, science-based husbandry setups, the division provides comprehensive technology backstopping, specialized training, and consultancy to a wide matrix of stakeholders, including farmers, regulatory bodies, and emerging industrial entrepreneurs.

Finfish Culture Division

The Finfish Culture Division focuses on developing comprehensive, scalable protocols for the captive breeding, nursery management, larval rearing, and grow-out culture of commercially vital brackishwater fish species. Its extensive food fish portfolio spans premium varieties such as the Asian seabass, mangrove red snapper, milkfish, striped grey mullet, streaked spinefoot, gold-lined seabream, and pearlspot. Driven by the critical need for species diversification, the division works to maximize the potential of underutilized brackishwater resources through modern, highly efficient rearing systems like open-water cage culture, pen culture, Recirculating Aquaculture Systems (RAS), and integrated multi-trophic setups (IMTA). This resource optimization is heavily supported by groundbreaking research in reproductive physiology, highlighted by recent achievements in inducing the precocious (early) maturation of Asian seabass to significantly shorten breeding cycles and ensure year-round seed availability.

To bridge the gap between laboratory innovation and commercial field implementation, the division actively patent-protects and disseminates its core technologies, including its newly patented, high-efficiency milkfish seed production technology. The division has also established a strong foothold in the high-value aquarium trade by mastering the complex seed production of native brackishwater ornamental fishes, including specialized species like chiseltooth Goby (*Mangarinus waterousi)*, tiger dwarf goby (*Mugilogobius tigrinus)*, and the mangrove pipefish *Ichthyocampus carce*, alongside popular favourites like the silver moony and spotted scat. It maintains close ties with the aquaculture community by extending consultancy-based technical guidance for setting up commercial fish hatcheries and nursery facilities. Through targeted interactive meets and customized training programs, the division equips farmers and stakeholders with the practical skills required to achieve economic resilience and long-term sustainability.

Nutrition, Genetics & Biotechnology Division

As the country's premier authority on aquaculture nutrition, this division focuses heavily on mitigating the high input costs of feed through innovative, indigenous processing technologies and alternative protein matrices. It has successfully established a comprehensive national database of Indian feed resources, enabling the creation of cost-effective, environmentally sustainable, and custom-formulated feeds tailored for all life stages of candidate finfish and shellfish. Notable breakthroughs include specialized functional feeds for broodstock and larvae, alongside the commercialization of fishmeal-replacement techniques utilizing customized enzyme mixtures, black soldier fly meal, and solid-state fermentation technology. Elevating its sustainability mandate, the division has spearheaded a landmark "Waste-to-Wealth" transformation technology, processing raw fish market waste into highly successful commercial organic inputs specifically 'CIBA-Plankton Plankton^{Plus} ' for aquatic feed optimization and 'CIBA-HortiPlus' for soil fertility.

In the realms of genetics and molecular biology, the division utilizes advanced genomics to map and enhance key economic traits of candidate species. The team has achieved a major milestone by completely sequencing and assembling the whole genomes of key aquaculture targets, including the Indian white shrimp (*Penaeus indicus*), Gold-lined seabream (*Rhabdosargus sarba*), Pearlspot (*Etroplus suratensis*), Grey mullet (*Mugil cephalus*), Mangrove red snapper (*Lutjanus argentimaculatus*), and Long-whiskered catfish (*Mystus gulio*), alongside critical bacterial pathogens like *Vibrio campbellii* and *Vibrio parahaemolyticus*. Recent genetic milestones also include the development of a high-density linkage map for tiger shrimp and the identification of Quantitative Trait Loci (QTL) against White Spot Syndrome Virus (WSSV) resistance using custom-designed SNP chips. Furthermore, the division boasts strong in-house bioinformatics capabilities, having developed pioneering open-access tools like the 'Missing Regions Finder' (MRF) for comparative genomic analysis and 'dbVAST', the first dedicated SNP search database for shrimp genetic improvement programs.

Aquatic Animal Health and Environment Division

The Aquatic Animal Health and Environment Division brings together expertise in aquatic animal health, biotechnology, microbiology, pathology, molecular diagnostics, epidemiology, environmental management, climate resilience, food safety, and traceability to support sustainable aquaculture development and tradability. The division focuses on disease surveillance, development of diagnostics and therapeutics, health management technologies, environmental monitoring, climate adaptation, decision-support system and traceability tools for aquaculture. During the year, the division generated critical epidemiological and environmental data through nationwide surveillance of major shrimp diseases and assessments of aquaculture ecosystems. Significant advances were made in understanding host–pathogen interactions, disease impacts, environmental stress responses, and the influence of climate and water quality on aquaculture health and productivity.

Major achievements included the development of CRISPR-based, multiplex LAMP, and quantitative real-time PCR diagnostic platforms for rapid pathogen detection; indigenous electrochemical sensors for real-time water quality monitoring; machine learning-based disease prediction models; ShrimpSIM, a web-based shrimp growth simulation tool; and LaksyaShrimp blockchain based digital traceability system. The division also established an Asian seabass muscle cell line, developed recombinant microalgae-based vaccine candidates against Viral Nervous Necrosis, and generated genomic insights into important aquatic pathogens.

A key accomplishment was the successful validation and nationwide dissemination of CIBA EHP Cura Gro+, which significantly improved shrimp health, survival, feed efficiency, and production across multiple states. Research on climate resilience and environmental sustainability supported responsible aquaculture expansion, climate risk mapping, flood impact assessment, greenhouse gas mitigation, and the development of climate-smart aquaculture strategies. Through innovation, technology development, field validation, and stakeholder outreach, the division continues to provide science-based solutions that enhance aquatic animal health, environmental sustainability, climate resilience, food safety and global marketability of Indian aquaculture.

Social Science Division

The Social Science Division serves as the critical bridge linking scientific innovation with grassroots implementation, ensuring that technology development remains need-based and aligned with macro policies. The division's extension models focus on upgrading the technical skills and knowledge capacities of end users while establishing strong forward and backward market linkages to maximize farmer income. By evaluating aquaculture systems through a techno-socio-economic lens, the team delivers vital feedback on technology adoption and market dynamics. These field insights shape effective policy advisories for regional and national sector planning, ensuring that coastal governance and regulatory supportive mechanisms remain responsive to the evolving needs of the industry.

A core mandate of the division is "reaching the unreached," directing specific focus toward small-scale aquaculture farmers, entrepreneurs, and socio-economically vulnerable coastal communities. This is achieved through the impactful execution of the Scheduled Caste Sub-Plan (SCSP) projects alongside the robust implementation of major national agricultural initiatives such as the Viksit Bharat Sankalp Yatra (VBSY) and related nationwide welfare and awareness campaigns. Through frontline extension services, targeted outreach programs, and tailored Information and Communication Technology (ICT) applications, the division democratizes access to scientific knowledge. This comprehensive socio-economic framework ensures that technical advancements generate equitable wealth, promote grassroot social development, and drive the overall long-term sustainability of the aquaculture sector.

Kakdwip Research Centre

Kakdwip Research Centre (KRC) is one of the oldest regional centres of ICAR–Central Institute of Brackishwater Aquaculture (ICAR-CIBA), located at Kakdwip in the ecologically important Sundarbans delta of West Bengal. Established in 1968 as a Brackishwater Experimental Fish Farm under CIFRI, Barrackpore, it was transferred to ICAR-CIBA on 1 April 1987 to strengthen brackishwater aquaculture research in eastern India. Spread over 17 ha, the centre comprises research facilities with traditional brackishwater ponds (bheries), research farms, laboratories, and administrative facilities. The research farm is organized into three sectors with earthen ponds and experimental units supporting diverse aquaculture programmes.

The centre has well-equipped wet laboratories, hatchery facilities, indoor and outdoor live-feed production units, an experimental feed mill, and modern recirculating aquaculture system (RAS) facilities for breeding Hilsa and other candidate fish and shrimp species. These facilities support research on seed production, nursery rearing, nutrition, health management, grow-out technologies, and integrated aquaculture systems.

KRC has made significant contributions to sustainable brackishwater aquaculture through development of biosecured zero-water-exchange shrimp farming, brackishwater finfish polyculture, and breeding and seed production technologies for Hilsa (*Tenualosa ilisha*), Bengal yellowfin seabream (*Acanthopagrus datnia*), long-whiskered catfish (*Mystus gulio*), and other candidate species. The centre has also developed Chingudi^{Plus} shrimp feed, Poly^{Plus} multispecies feed, and farm inputs such as Plankton Plankton^{Plus} and Horti^{Plus}, enhancing productivity and farmer livelihoods. Through research, technology dissemination, training, and stakeholder engagement, KRC continues to promote resilient, climate-smart, and sustainable brackishwater aquaculture in eastern India.

Navsari Gujarat Research Centre

The Navsari Gujarat Research Centre (NGRC), established in 2018 within the Navsari Agricultural University campus, functions as the ICAR-Central Institute of Brackishwater Aquaculture's strategic west coast station. Located along the historic Dandi Heritage Road in Matwad village, the centre operates a 10-hectare research farm in South Gujarat, one of the nation's most intensive shrimp farming hubs.

NGRC of ICAR-CIBA contributed to regional economic development through the development, validation and demonstration of commercially viable brackishwater aquaculture technologies, including high-density shrimp farming in HDPE-lined ponds and multi-species farming systems. Furthermore, the centre excels in cage-based community seed production for pearlspot, as well as focused nursery and grow-out practices for both pearlspot and Asian seabass. Committed to sustainability and biosecurity, NGRC conducts ongoing seaweed-shrimp integration studies and leverages its diagnostic laboratory to actively screen and report emerging pathogens from brackishwater farms and hatcheries across the Western region.

Under tribal livelihood programmes, the centre has established integrated aqua-agri-poultry-goat models that enhance local productivity and income generation. Technology dissemination is continually strengthened through targeted stakeholder partnerships and outreach training. Concurrently, NGRC marks significant progress on key government-funded projects, focusing on establishment of aquatic referral laboratory infrastructure, super-intensive precision natural shrimp farming demonstration units and aquaculture zone planning to ensure responsible expansion of brackishwater aquaculture across Gujarat and Maharashtra.

Research Highlights

01

Diversification and Precision Aquaculture

Diversification and Precision Aquaculture

Production performance of Pacific white shrimp in a modified high-density HDPE-lined pond system

To overcome the limitation of coastal land availability in South Gujarat, small HDPE geomembrane-lined ponds with a modified sloped bottom and central drainage system were developed for high-density culture of *Penaeus vannamei* in a creek-based farming cluster at Navsari. In Crop 1, nursery-reared juveniles (~0.06 g; 35 days old) were stocked at densities of 94-104 shrimp/m² in ponds ranging from 960 to 1000 m². Harvested shrimp attained average body weight (ABW) of 9.94-11.25 g, yielding 898-914 kg per pond with good survival (96.6-97.9%), a low feed conversion ratio (FCR) of 0.96-1.01, and a productivity of 8.98-9.51 t/ha. In Crop 2, larger nursery-reared shrimp (~0.24 g; 50 days old) were stocked at 117-134 shrimp/m² in ponds of 700-1000 m². After 92 days, shrimp reached ABWs of 24.21-25.06 g, producing 1,525-1,562 kg per pond with a productivity of 18.93-22.0 t/ha/crop. Survival ranged from 70.96 to 74.10% and FCR from 1.33 to 1.36. Growth and condition indices indicated healthy shrimp, demonstrating that modified HDPE-lined ponds can sustainably achieve productivity exceeding 20 t/ha in creek-based farming systems.

Shrimp harvest from modified HDPE-lined ponds

Modified HDPE-lined ponds

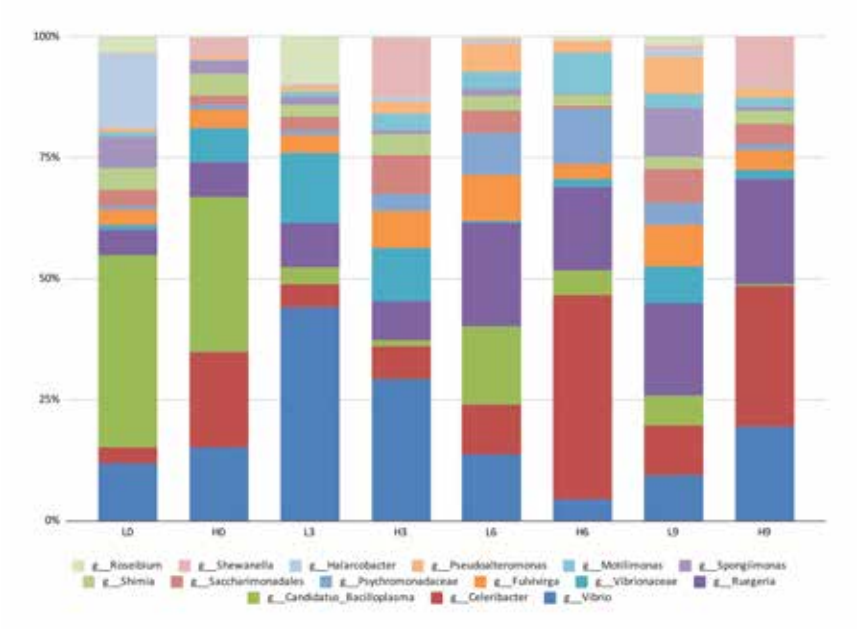
Nursery rearing of Pacific white shrimp in an indoor tank system

Two nursery-rearing trials of *Penaeus vannamei* were conducted in an indoor nursery facility at Navsari, Gujarat. The system comprised three 50-tonne tanks, each equipped with central drainage and twenty air diffusers, connected to two 7.5 HP roots blowers operated alternately. In the first trial, postlarvae were stocked at 1 lakh per tank (2,500 nos./m³ in a 40-tonne water volume) and reared for 32 days. Survival rates were 87.3%, 100.0%, and 90.2% in nursery tanks N1, N2, and N3, respectively, with a mean body weight of 0.045 ± 0.02 g. In the second trial, *P. vannamei* were reared for 50 days due to the prevalence of WSSV in the region, achieving a mean body weight of 0.25 ± 0.04 g, with survival rates of 72.15%, 57.82%, and 62.16% in the respective tanks. Postlarvae were fed a micro-particulate diet (150–800 µm), water was exchanged twice weekly, and ammonia spikes (>2.0 ppm) were effectively managed through carbon-source application.

Indoor shrimp nursery in operation

Effects of stocking density on gut microbiota dynamics in Pacific white shrimp cultured in SIPNSF system

Temporal changes in the gut microbiota of *Penaeus vannamei* reared under low-density (190 shrimp/m³) and high-density (380 shrimp/m³) SIPNSF systems were assessed following transfer to clear water. At day 0, the low-density group was dominated by *Candidatus sp. and Bacilloplasma sp.,* whereas the high-density group exhibited a more heterogeneous microbial community with a higher abundance of *Vibrio sp.* and other Proteobacteria *sp.* By day 3, both groups showed a marked increase in *Vibrio sp.*, indicating an acute response to environmental change. Between days 6 and 9, microbial communities became more diverse, with increased abundance of *Ruegeria sp.*, *Fulvivirga sp.*, *Pseudoalteromonas sp.*, *Shimia sp.*, and *Shewanella sp.*, reflecting ecological succession and functional stabilization. High-density shrimp exhibited higher microbial turnover, more unique ASVs, and higher β-diversity dispersion, indicating reduced microbial stability and greater inter-individual variation. In contrast, low-density shrimp showed tighter clustering and more consistent community restructuring. Overall, stocking density had lasting effects on gut microbiota composition, with high-density conditions associated with greater instability and increased risk of dysbiosis following environmental transition.

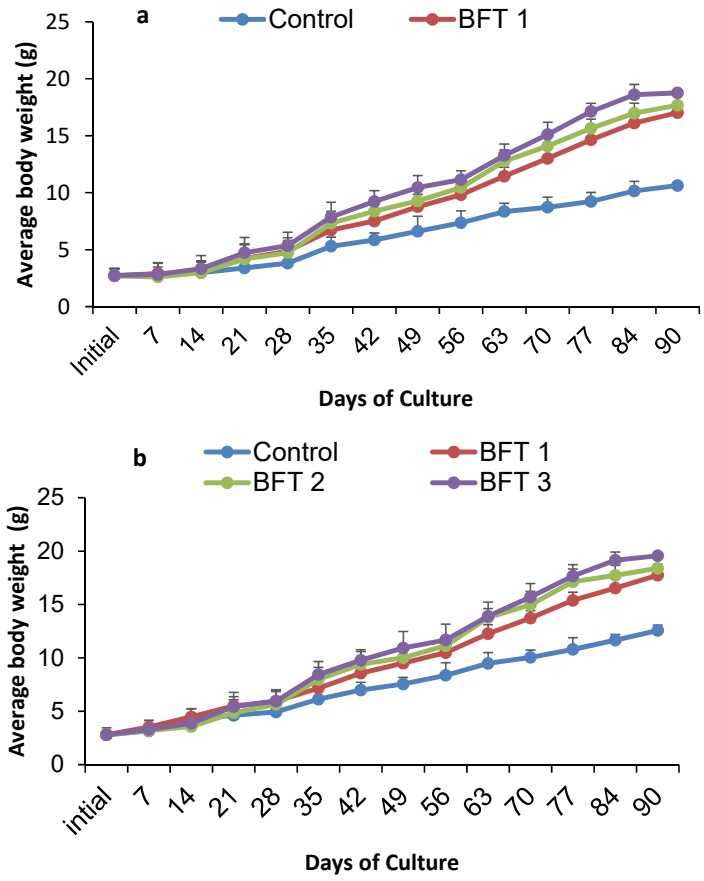


Relative abundance of microbiota in the gut of *P. vannamei* reared at two stocking densities in SIPNSF

Comparative performance of Indian white shrimp and Pacific white shrimp in a biofloc-based super-intensive rearing system

A 90-day experiment was conducted to evaluate water quality, microbial dynamics, and immune responses in biofloc-based culture systems. Four treatments were tested: Control (C0), BFT1 (CIBAFLOC), BFT2 (biofloc + mineral mix), and BFT3 (CIBAFLOC + periphytic substrate). Postlarvae (PL12) of *Penaeus indicus* and *Penaeus vannamei* were stocked in 15-tonne tanks at a density of 3,000 nos./m³, with an initial

body weight of 2.7 ± 1.0 g. A C: N ratio of 15:1 was maintained across all treatments. The highest growth performance was observed in BFT3, with final weight gains of 19.56 ± 0.79 g in *P. vannamei* and 18.76 ± 0.89 g in *P. indicus* after 90 days. Enhanced activities of key biochemical parameters, including amylase, triglycerides, glucose, LDH, cholesterol, alkaline phosphatase, AST, and ALT, were recorded in both species. Antioxidant activity (SOD) and immune responses, indicated by phenoloxidase and lysozyme activities, were also elevated, particularly in *P. indicus*. These findings demonstrate the beneficial effects of biofloc systems, especially BFT3, on shrimp growth, health, and immunity.



Growth performance of *P. indicus* (a) and *P. vannamei* (b) in a biofloc-based rearing system over 90 days

Performance of tiger shrimp in different stocking densities in a natural feed-based precision intensive farming system

A 142-day study evaluated the effects of three stocking densities: high (HSD, 100 shrimp/m³), medium (MSD, 60 shrimp/m³), and low (LSD, 30 shrimp/m³) on growth, survival, feed efficiency, and water quality in six HDPE grow-out tanks (12 m diameter; 150-ton capacity). *Penaeus monodon* post-larvae (PL21; initial average body weight 0.012 g) were reared under semi-floc conditions. The highest final average body weight was recorded in LSD (38.4 g), followed by MSD (37.0 g) and HSD (28.5 g). Survival was also highest in LSD (98%), compared to HSD (92%) and MSD (82%). Biomass production, however, was greatest in HSD (788.9 kg), followed by MSD (539.7 kg) and LSD (350.3 kg). Feed conversion ratio was lowest in LSD (1.58), 1.66 in MSD, and 1.77 in HSD. Overall, lower stocking densities improved growth, survival, and feed efficiency, whereas higher densities maximized biomass yield, highlighting the need for optimized stocking strategies in sustainable shrimp farming.

Tiger shrimps produced in a higher stocking density in SIPNSF

Study on the effect of fermented microbial consortium in a biofloc culture system

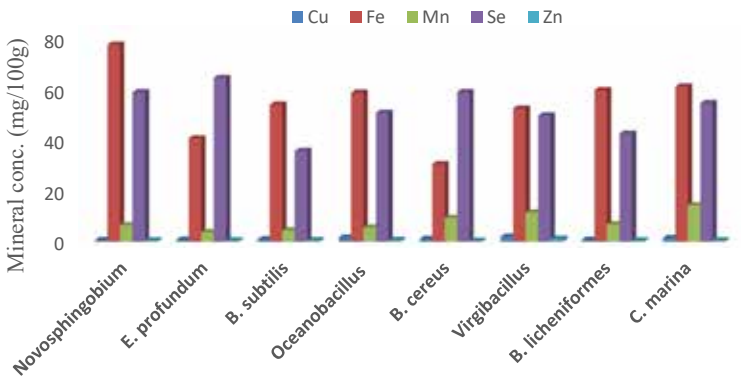
A 45-day experiment was conducted to evaluate the effect of a microbial consortium fermented using a solid-state fermenter on the growth, survival, immunological parameters, and expression of immune and digestive-related genes in *Penaeus vannamei*. The results showed significantly ($p < 0.05$) higher growth in the fermented biofloc (FB) treatment group (9.70 ± 1.60 g), followed by control biofloc (CB, 9.50 ± 1.42 g), unfermented biofloc (UFB, 9.21 ± 0.98 g), fermented clearwater (FCW, 9.15 ± 1.79 g), control clearwater (CCW, 8.70 ± 1.44 g), and the lowest growth in unfermented clearwater (UFCW, 7.99 ± 1.47 g). A similar trend was observed for survival, with the FB group recording the highest survival rate (97.2 ± 2.5%) compared to the control group (81.6 ± 1.66%). The FB dietary treatment also resulted in significantly improved ($p \leq 0.05$) growth performance, serum immune responses, and relative expression of digestive enzyme-related genes in *P. vannamei* compared with the unfermented and control groups.

Parameter	CB	UB	FB	FCWS	UCWS	CCW
Initial wt. (g)	4.0^{a}±0.8	4.1^{a}±0.76	4.0^{a}±0.9	4.1^{a}±0.6	4.1^{a}±0.76	4.1±0.9
Final wt.(g)	9.2^{bc}±1.42	9.1^{bc}±0.98	9.7^{c}±0.5	8.7^{b}±1.09	7.9^{a}±1.47	9.4±1.44
FCR	1.18^{ab}±0.03	1.45^{b}±0.64	1.06^{a}±0.52	1.35^{b}±0.68	1.8^{c}±0.69	1.6±0.64
Survival (%)	95^{c}±1.66	91.6^{b}±0.68	97.2^{c}±1.54	89.4^{b}±1.18	83.3^{a}±0.69	81.6±0.52

Growth parameters of *P. vannamei* (mean ±SD) for different dietary groups in biofloc system

Production of iron and selenium-enriched biofloc using chelated minerals

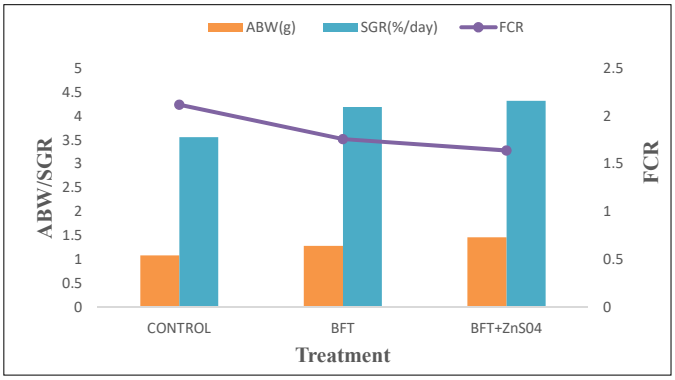
A pilot study was conducted to evaluate the ability of different bacterial isolates, i.e. *Novosphingobium sp., Exiguobacterium profundum, Bacillus subtilis, Oceanobacillus sp., B. cereus, Virgibacillus sp., B. licheniformes and Cobetia marina, to* produce iron and selenium (Fe and Se) enriched biofloc in the presence of chelated trace minerals. The mineral analysis indicated that the addition of chelated selenium and iron promoted the formation of stable bioflocs, with the minerals being effectively assimilated and retained within the floc matrix. The extent of accumulation varied among bacterial isolates. These enriched flocs also supported the proliferation of beneficial microorganisms and rotifers within the system. Overall, the study demonstrated that chelated trace minerals can facilitate the production of mineral-enriched biofloc, potentially improving nutrient recycling and enhancing the nutritional quality of the culture environment in biofloc-based aquaculture systems.



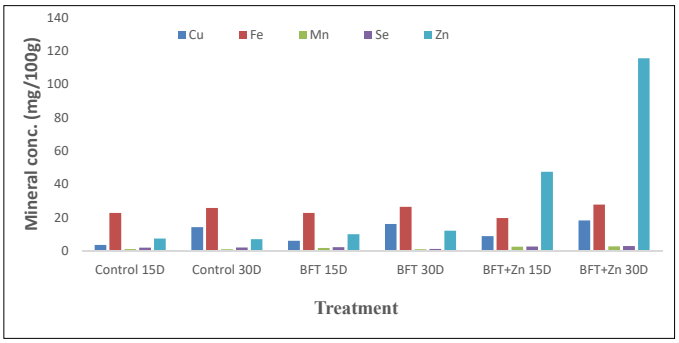
Mineral assimilation in the biofloc after enriching with chelated Fe and Se

Evaluation of nursery performance of Pacific white shrimp using zinc-enriched biofloc microbial consortium

A 45-day feeding trial was conducted to evaluate the effects of zinc supplementation on *Penaeus vannamei* post-larvae cultured in biofloc systems. Post-larvae were stocked in 300-L tanks at a density of 0.35 PL/L (30 post-larvae per tank), and the treatment group received continuous exposure to $ZnSO_4$ at 20 ppm. Growth performance, water quality, zinc assimilation in muscle tissue, and the expression of antimicrobial peptide (AMP) genes were assessed at the end of the trial. Zinc concentration in shrimp muscle was significantly higher in the zinc-supplemented biofloc treatment (115.51 mg/100 g) than in the control (7.54 mg/100 g), indicating efficient mineral assimilation. Zinc supplementation improved average body weight (1.46 g), survival (88.33%), and AMP gene expression. The integration of zinc supplementation with biofloc technology enhanced aquaculture performance, increasing average body weight by 37% and specific growth rate by 21%, while reducing feed conversion ratio by 22% compared to the control. These findings highlight the potential of zinc fortification to improve shrimp productivity, health, and disease resistance.



Growth performance of *P. vannamei* using a zinc-enriched biofloc microbial consortium

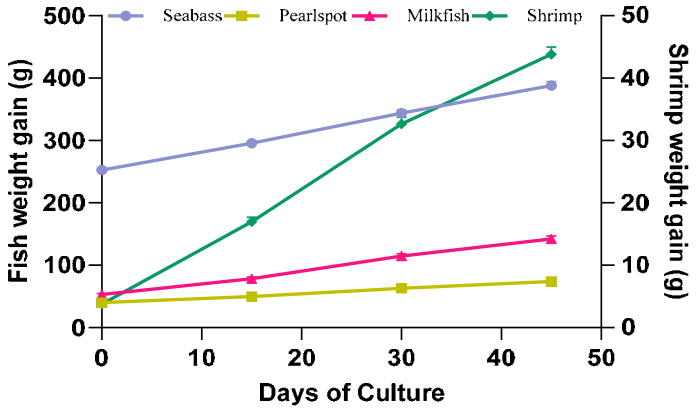


Quantification of trace minerals in shrimp muscle following zinc-supplemented biofloc treatment

Comparison of multi-species culture of seabass, pearlspot, milkfish and shrimp in a cage-cum-pond system

A 45-day study was conducted at CIBA-NGRC to evaluate a multi-species aquaculture system integrating cage-cultured *Lates calcarifer* and *Etroplus suratensis* with pond-reared *Chanos chanos* and *Penaeus monodon*. *L. calcarifer* at 400 nos/cage (size: 251.3 ± 3.2 g) and *E. suratensis* at 100 no/cage (40.18 ± 1.5 g) were cultured in the inner and outer nets of the cages, respectively, while *C. chanos* (100 no., size: 52.6 ± 1.3 g) and 90-day nursery-reared *P. monodon* (3000 no., size: 3.58 ± 0.1 g) were stocked in the open pond. *L. calcarifer* were fed Ciba Seabass^{plus} (45% crude protein) twice daily, and *P. monodon* received Ciba Chingudi^{plus} (32% crude protein) four times daily based on biomass. *E. suratensis* and *C. chanos* primarily utilized uneaten feed and natural pond productivity. Growth performance, survival, health status, and water quality were

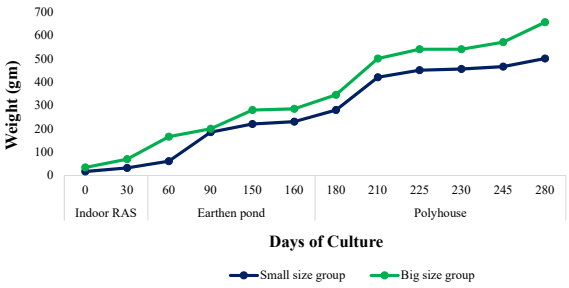
monitored throughout the study. Water quality parameters remained within optimal ranges, supporting satisfactory growth and survival of all cultured species. *C. chanos* efficiently utilized natural productivity, whereas *P. monodon* exhibited rapid growth. The findings demonstrate that integrating fish and shrimp in a cage-cum-pond system can improve resource utilization, enhance overall productivity, and offer a technically feasible and economically viable aquaculture strategy.



Fish and shrimp weight gain over 45 days in a multi-species culture system

Asian seabass farming trial in an inland saline area

Asian seabass, a euryhaline species, has considerable potential for culture in inland saline-affected areas. A collaborative farming trial was conducted with the College of Fisheries, Guru Angad Dev Veterinary and Animal Sciences University (GADVASU), Ludhiana, Punjab. A total of 1,000 hatchery-produced seabass fingerlings (16–40 g) were transported and acclimatized in an indoor freshwater recirculating aquaculture system (RAS) tanks in April 2025. Following a one-month quarantine period, 837 advanced juveniles (59–84 g) were transferred to a biosecure 0.1-ha earthen pond and reared until September. As pond water temperatures declined to 13–15°C in October, fish (average body weight: 345 g) were shifted to an indoor RCC polyhouse (80 m²), where water temperature was maintained at 22–23°C using ten 500-W thermostatic heaters. After eight months of culture, seabass fed with SEABASS Grow-Out^{PLUS} feed at 3–5% body weight attained an average weight of 580 g. The study demonstrated the feasibility of seabass farming in inland saline regions of Punjab even during winter months by optimizing stocking timing, seed wintering and using a polyhouse for extended farming time.

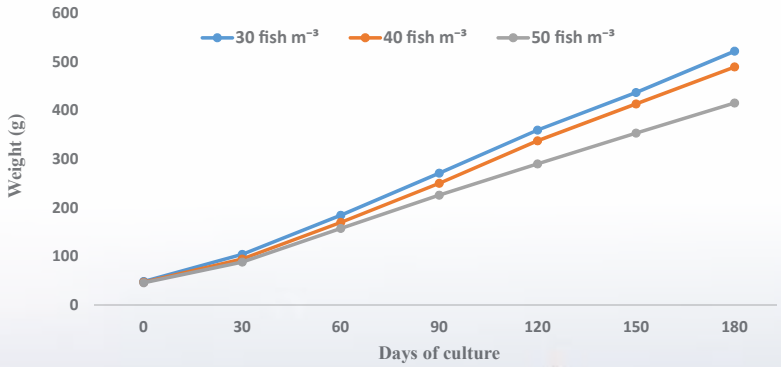


Growth dynamics of seabass in RAS, earthen pond & polyhouse

Seabass stocked inside the polyhouse and fed with SEABASS Grow-Out^{PLUS} at GADVASU, Punjab

Optimization of stocking density for pond-based cage culture of Asian seabass

A 180-day experiment was conducted to evaluate the growth, survival, and production performance of Asian seabass (average length: 16.04 ± 0.2 cm; average weight: 46.8 ± 0.8 g) reared at stocking densities of 30, 40, and 50 fish/m³ in 16 m³ grow-out cages (4 × 4 × 1 m) installed in a 6,000 m³ pond. The trial was conducted in collaboration with a tribal Self-Help Group (SHG) from Sultanpur village, Navsari, Gujarat. Fish were fed CIBA Seabass grow-out^{PLUS} feed (45% crude protein) twice daily to apparent satiation, and cages were cleaned weekly. Growth and health assessments were conducted at 15-day intervals. Growth parameters, including length gain, weight gain, specific growth rate (SGR), and survival, were significantly higher ($p < 0.05$) at lower stocking densities (30 and 40 fish/m³) than at 50 fish/m³. Based on biological performance, a stocking density of 40 fish/m³ was identified as the optimal level for seabass grow-out culture in pond-based cages.

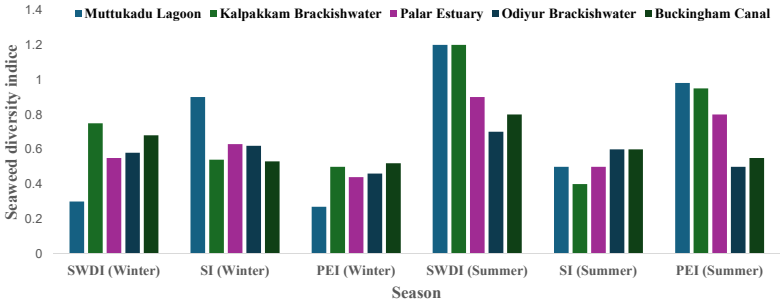


Weight (g) of seabass reared at different stocking densities in growout cages in a pond for 180 days

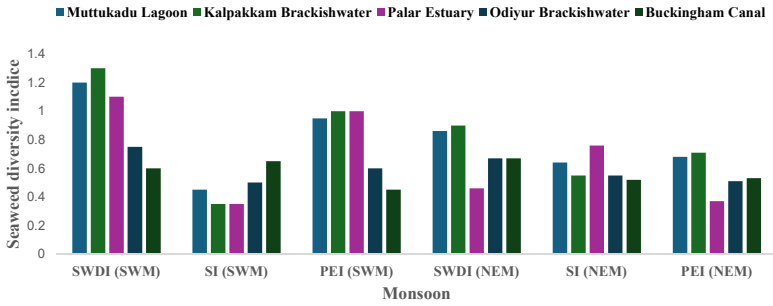
Cage farming of seabass at different stocking densities in a pond for 180 days

Assessment of seaweed biodiversity in brackishwater systems in Chengalpattu district, Tamil Nadu

Seaweed farming is an important and sustainable aquaculture practice worldwide. An investigation was conducted to determine the diversity and seasonal dynamics of seaweed species in the brackishwater ecosystems of Chengalpattu district, Tamil Nadu, India. Surveys were carried out at 22 sites, including the Buckingham Canal, Muttukadu Lagoon, Kalpakkam brackishwater area, and Palar Estuary, across four seasons. Biodiversity was assessed using the Shannon-Wiener (SWDI), Simpson(SI), and Pielou's Evenness indices (PEI). The results revealed significant spatial and seasonal variations in seaweed communities, with Muttukadu Lagoon and the Kalpakkam brackishwater area emerging as biodiversity hotspots exhibiting relatively high species diversity. Greater species richness and evenness were observed during the summer and southwest monsoon seasons. In contrast, persistent species such as *Gracilaria tenuistipitata* and *Ulva prolifera* demonstrated strong ecological resilience across all seasons.



Seaweed diversity during different seasons across Chengalpattu district, Tamil Nadu



Seaweed diversity during the South-West and North-East monsoon across Chengalpattu district, Tamil Nadu

Integrated seaweed-shrimp farming: a sustainable farming model for production and profitability

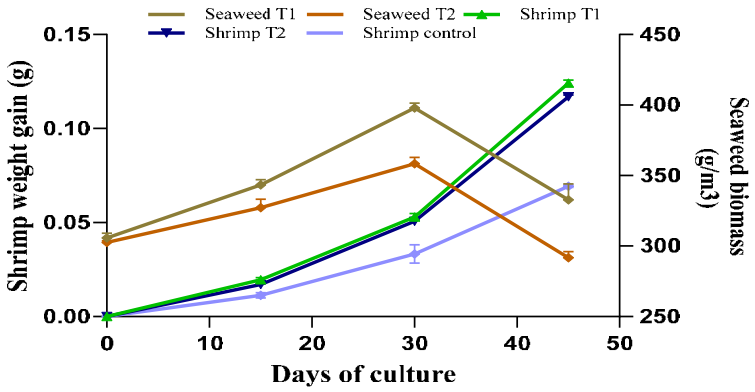
Integration of *Gracilaria salicornia* with *Penaeus vannamei* was evaluated in lined ponds at ICAR-CIBA with a stocking density of 40 nos/m² (PL 12) at 25 ppt salinity. An initial biomass of 32 tube nets of seaweed, each weighing 6 kg, was introduced at the commencement of the culture period. The seaweed-integrated system demonstrated superior performance compared to the control (without seaweed). Shrimp reared in the integrated ponds achieved a higher average body weight of 23.2 g than those in the control ponds (19.7 g). Total yield was higher in the integrated system (9.2 tons/ha) than in the control (7.1 tons/ha). Furthermore, feed efficiency improved, with a lower FCR of 1.36 compared to 1.47 in the monoculture. In addition to enhanced growth and production, the integrated system contributed to improved water quality parameters throughout the culture period. The system recorded a seaweed productivity of 12.3 tons/ha by 107 days of cultivation, demonstrating the added economic and ecological benefits of seaweed-shrimp integration.

Seaweed and shrimp harvest at MES, ICAR-CIBA

Seaweed Integrated Shrimp Farming (SISF)

Integrated nursery rearing of Indian white shrimp with seaweeds

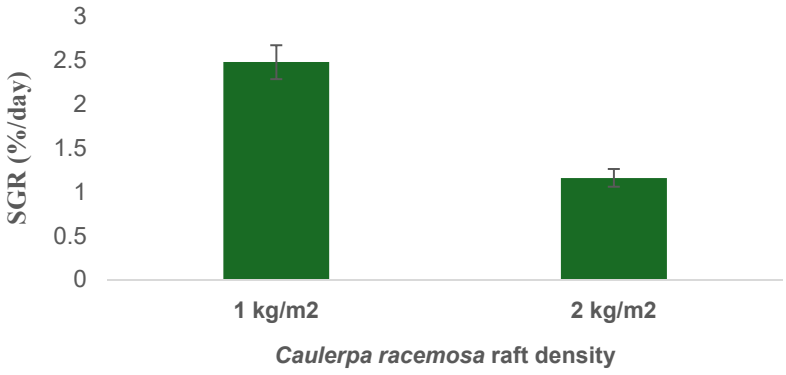
A 45-day integrated nursery trial was conducted to evaluate the performance of Indian white shrimp (*Penaeus indicus*) co-cultured with two *Gracilaria* seaweed species, *G. corticata* (T1) and *G. foliifera* (T2) and a control (shrimp without seaweed). Shrimp postlarvae were stocked at a density of 3,000 PL/m³, while seaweeds were stocked at 0.3 kg/m³. Results showed that shrimp reared in seaweed-integrated systems attained significantly higher mean body weights than those reared in monoculture. The crude protein content of shrimp was also enhanced in the integrated treatments, reaching 63.56% with *G. corticata* and 62.45% with *G. foliifera*, compared to 61.67% in the control. Among the two seaweed species, *G. corticata* exhibited superior growth, recording a specific growth rate (SGR) of 1.4% by day 30, whereas *G. foliifera* achieved an SGR of 0.97%. The study demonstrates the potential of seaweed–shrimp integration to improve shrimp growth, nutritional quality, and overall productivity of nursery-rearing systems.



Seaweed and shrimp weight gain during the co-culture trial

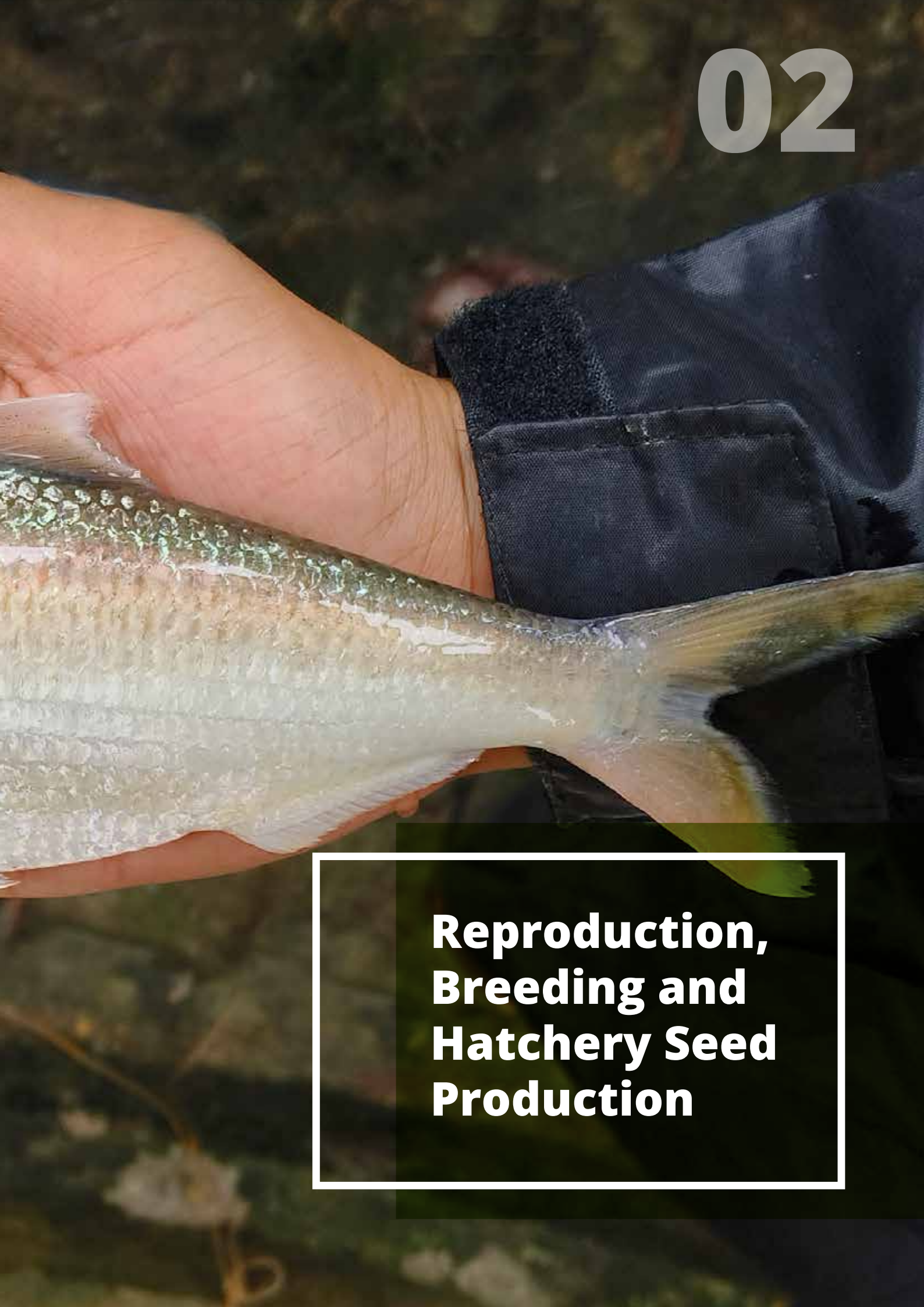
Density-dependent growth of seaweed integrated into a shrimp-farming system

A study was conducted to assess the growth performance of *Caulerpa racemosa* at two stocking densities integrated into a high-density (*Penaeus vannamei*, 150 no./m²) culture pond. The experiment employed a raft culture system with two treatments: a low-density treatment (1 kg/m²) and a high-density treatment (2 kg/m²). Each treatment consisted of four replicates (n = 4), with initial biomasses of 250 g and 500 g per section, respectively. After a 30-day cultivation period, the results revealed a significant inverse relationship between stocking density and growth rate. The 1 kg/m² treatment achieved a significantly higher specific growth rate (SGR) of 2.47%, compared to 1.16% in the 2 kg/m² treatment. Statistical analysis (t-test) confirmed that the difference was slightly significant ($p<0.01$), indicating that lower stocking densities promote faster individual growth. The study concludes that a stocking density of 1 kg/m² is more effective for maximizing the growth performance of *C. racemosa* in pond-based raft culture systems.



Growth performance of seaweed at different stocking densities

02



Reproduction, Breeding and Hatchery Seed Production

Reproduction, Breeding and Hatchery Seed Production

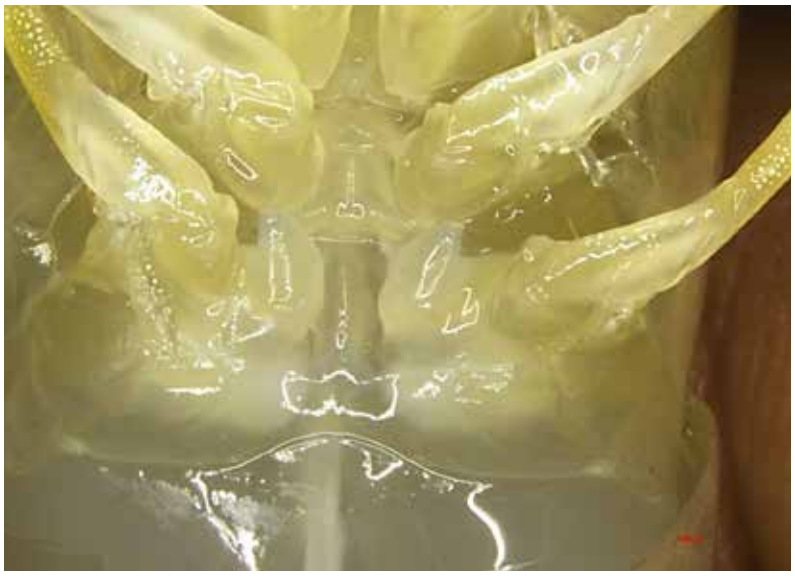
Artificial insemination trials in Indian white shrimp

Artificial insemination is a key technique in shrimp culture aimed at improving reproductive efficiency and genetic selection. It enables controlled breeding, which is extremely useful in the production of specific traits in improving hatchery outcomes to support selective breeding programs. Newly moulted mature *Penaeus indicus* females were inseminated with a male spermatophore when the thelycum is soft. The spermatophore-implanted female was released to the maturation tank and closely monitored for the development of eggs. Altogether, 23 artificial inseminations were conducted during this period. The artificial insemination methodology involved eyestalk ablation with stress-free handling of the broodstocks with improved fertility results. Use of anaesthesia (Eugenol at 100 mg/L) increased the spermatophore acceptance rate and reduced mortality due to handling stress. Results revealed considerable progress on optimizing the artificial insemination protocol in terms of successful spawning.

Insertion of spermatophore in female thelycum

Standardization of electro-extrusion for spermatophore collection in Indian white shrimp

Electro-extrusion was standardized as a non-lethal, repeatable, and efficient method for spermatophore collection in *Penaeus indicus*, facilitating improved captive broodstock management. The technique involved the application of a mild and controlled electrical stimulus to mature males, inducing muscular contractions that resulted in the extrusion of intact spermatophores without causing physical injury or mortality. The study demonstrated that the optimal voltage requirement is size-dependent, and appropriate voltage selection is critical to achieve 100% spermatophore extrusion while ensuring broodstock welfare. The standardized protocol proved to be a reliable and animal-friendly approach, enabling repeated spermatophore collection without impairing spermatophore regeneration. This technique has significant potential to enhance the efficiency of controlled breeding programmes and hatchery seed production of *P. indicus*.



Regenerated spermatophores after electro-extrusion in *Penaeus indicus*

Studies on the reproductive potential of kuruma shrimp for species diversification

To evaluate the reproductive potential of kuruma shrimp, *Penaeus japonicus*, 186 brooders were collected from the Chennai coast. Males recorded a total length of 15.57 cm, with an average body weight (ABW) of 35.36 g (22–49 g), whereas females were larger, with 19.2 cm total length and 70 g ABW (43–98 g). The population exhibited a male-biased sex ratio of 2.7:1. Altogether, 45% of males were at stage III maturity, and 49% of females were mated. Captive spawning of wild brooders was achieved in a pond where PL attained an ABW of 7.5 g in five months. In salinity tolerance trials, juveniles reared at 40 ppt attained the highest ABW (0.70 g) with 62% survival, followed by 25 ppt (0.38 g; 67% survival), while 3 ppt resulted significantly ($p<0.05$) reduced growth (0.2 g) and survival (26 %). Salinity tolerance results suggest that *P. japonicus* juveniles are better adapted to higher salinity regimes.

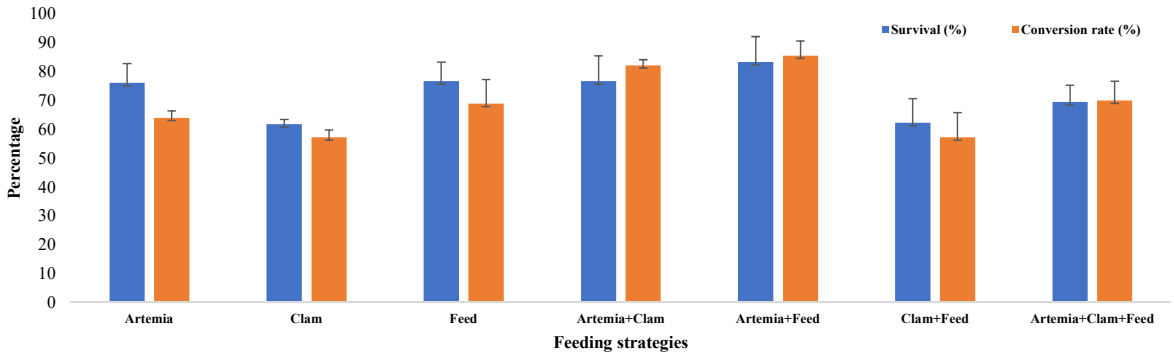
P. japonicus brooders

P. japonicus juveniles

Growth performance of blue swimmer crab from megalopa to first instar stage under different feeding protocols

Understanding the specific nutritional needs of larvae is a critical step in optimizing aquaculture production and ensuring high survival rates during early life stages. To investigate the optimal dietary requirements for *Portunus reticulatus* larval development, the study evaluated the effects of seven distinct nutritional treatments across triplicate groups, maintained at a stocking density of 50 larvae per 100 L. The experimental design utilized single-source diets comprising Clam, Artemia nauplii, and Formulated feed alongside various combinations: Artemia + Clam, Clam + Formulated feed, Artemia + Formulated feed, and a total mixture of all three sources. Key performance indicators, including survival and conversion rates, were monitored to determine the most effective feeding strategy. The results demonstrated that the Artemia + Formulated feed combination yielded the highest overall survival. Similarly, this treatment produced the superior conversion rate, followed closely by the Artemia + Clam group, suggesting that co-feeding strategies significantly outperform single-source diets in promoting robust larval growth.

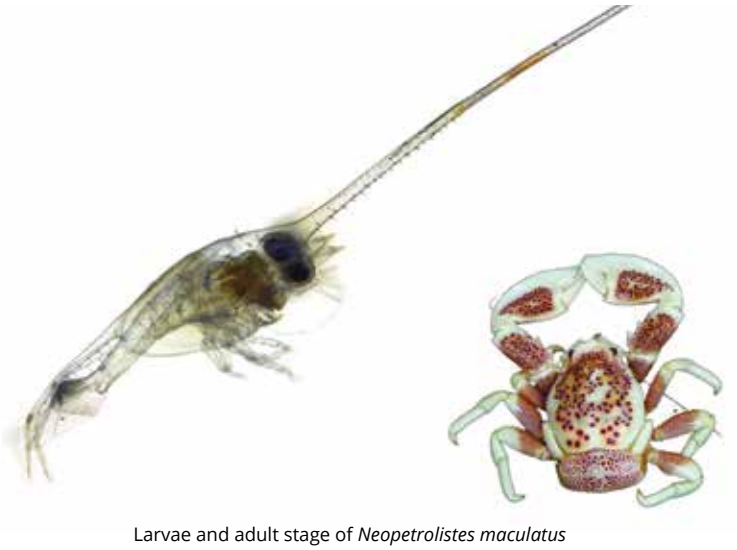
Hatchery produced instars of blue swimmer crab (*P. reticulatus*)



Survival and conversion rate of *P. reticulatus* under different feeding strategies

Larval rearing of ornamental spotted porcelain crab

Initial investigations were conducted to study the larval development of the spotted porcelain crab, *Neopetrolisthes maculatus*. Eggs from berried females measured approximately 1243.89 µm in length and 1185.95 µm in width, with 70% yolk content. The experimental protocol involved rearing larvae at 28 ppt salinity and 28±1°C, utilizing a regimen of continuous bottom siphoning from 3 days post-hatch (DPH) and daily water exchanges

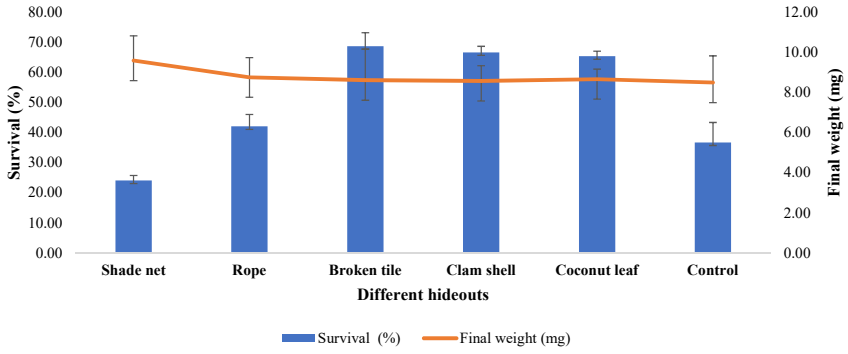


Larvae and adult stage of *Neopetrolistes maculatus*

ranging from 25% to 50% to mitigate ammonia accumulation. Larvae successfully reached the Zoea 2 stage by 6 DPH and transitioned to feeding on enriched *Artemia* nauplii. Feeding efficiency was hindered by the uneven distribution of *Artemia* nauplii towards the surface. Despite intensive maintenance, complete mortality occurred by 15 DPH. These results highlight the species' complex larval development but emphasize that future trials must prioritize more sophisticated water quality management and optimized feeding strategies to ensure long-term larval survival.

Evaluation of different hideouts for the nursery rearing of green mud crab

To evaluate optimal nursery conditions for mud crab production, a study was conducted to identify the most effective hideout substrate for rearing larvae of *Scylla serrata* from the megalopa to the crab instar stage. The experimental design utilized five distinct treatments: split fiber rope, clam shells, broken tiles, coconut leaves, and shade nets, alongside a substrate-free control, each maintained in triplicate at a stocking density of 50 megalopa per 100 L. Results indicated that the inclusion of substrates significantly enhanced larval success, with the highest survival rates recorded in the broken tile treatment, closely followed by clam shells and coconut leaves. Statistical analysis showed no significant variation in survival among these three top-performing substrates, and the average body weight remained uniform across all groups due to the standardized feeding protocol maintained throughout the trial. These findings suggest that utilizing durable, accessible materials like broken tiles can effectively minimize cannibalism and improve nursery yields.



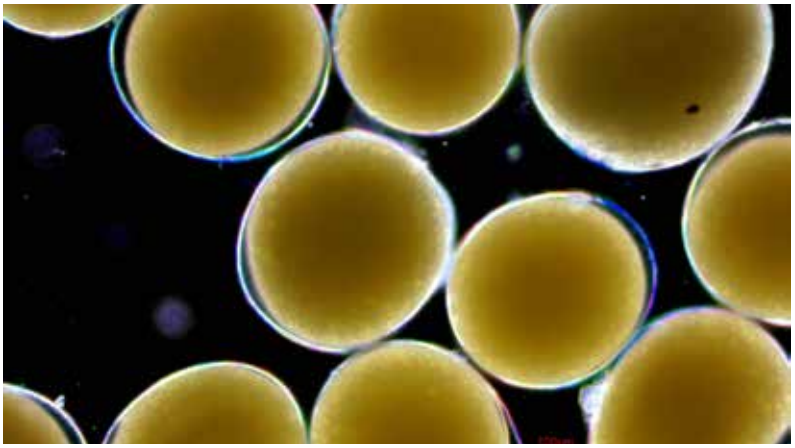
Survival and final weight of *Scylla serrata* after nursery rearing in different hideouts

Successful spawning of orange mud crab in indoor maturation system

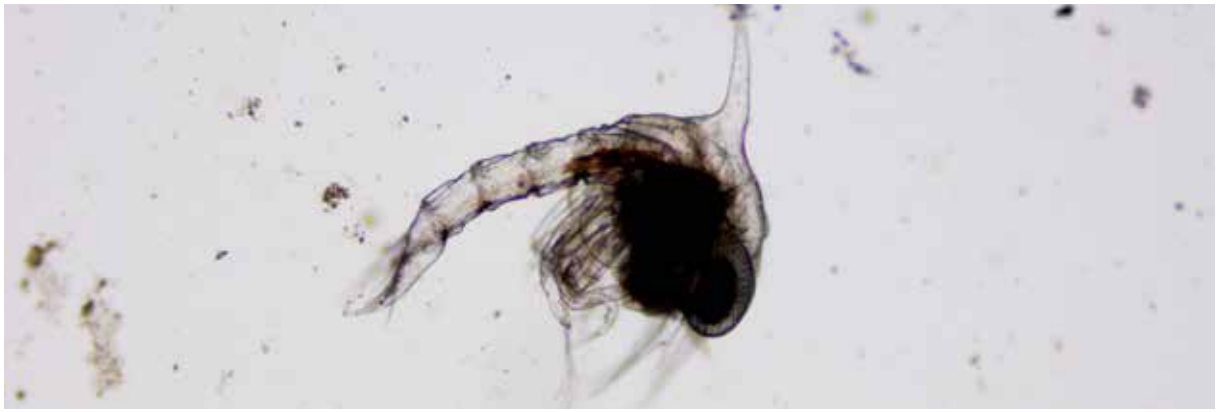
Maturation and breeding of orange mud crab (*Scylla olivacea*) were carried out at the Kakdwip Research Centre of ICAR-CIBA using an indoor maturation system. Wild-caught mature females (carapace width: 119.75±2.04 mm; body weight: 307.16±14.46 g) were reared individually in 400 L tanks at 25 ppt salinity and 29±1°C, with a biofilter system and sand beds

Female *Scylla olivacea* spawning in sand bed

to facilitate spawning. Crabs were fed with a combination of trash fish and squid meat at 10% of body weight, and unilateral eyestalk ablation was performed after two weeks of conditioning. Successful spawning occurred with an average latency of 23.2 ± 4.88 days post-ablation. Berried crabs were monitored for egg development, and hatching occurred 9 days after spawning. Fecundity ranged from 1 to 5 million eggs, with a hatching success of 70–78%, demonstrating the effectiveness of the indoor maturation system.



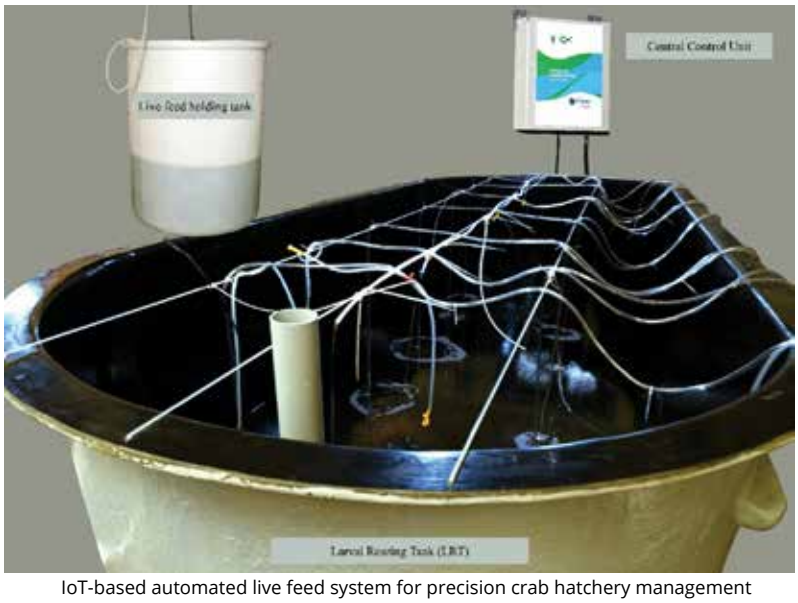
Freshly spawned eggs of *Scylla olivacea*



Hatched out Zoea 1 larvae of *Scylla olivacea*

IoT-based automated live feed system for precision crab hatchery management

The IoT-based automated live feed system, developed by ICAR-CIBA, represents a major advancement in crab hatchery management by enabling precise, automated feeding through integration of a central control unit with larval rearing tanks. The system ensures accurate feed delivery at scheduled intervals, reducing human error and labour dependency while promoting uniform larval growth and improved survival rates. It operates in both access point mode for reliable local control without internet and Wi-Fi mode for remote monitoring, enhancing operational flexibility. The system also allows easy adjustment of feed quantity and timing based on larval stages, making it adaptable and scalable for broader aquaculture applications. By replacing manual practices with a standardized, data-driven approach, this innovation enhances hatchery efficiency and sustainability, ultimately improving larval survival and ensuring a consistent supply of crab seeds to support farming livelihoods.



IoT-based automated live feed system for precision crab hatchery management

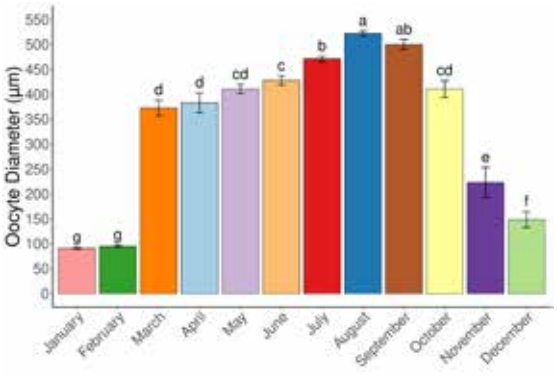
Strengthening the grey mullet broodstock with proper quarantine, vaccination and tagging under captive system

A total of 90 grey mullets, *Mugil cephalus* (600 g - 1.2 kg), were maintained in two 100-ton RCC tanks. All individuals were tagged and vaccinated. Initial biopsy sampling conducted in late October identified 21 maturing females with oocytes measuring approximately 82 µm in diameter along with vitellogenic oocytes averaging 279 µm. Male spermiation was also observed during this period. To accelerate oocyte development, GnRH (Gonadotropin-Releasing Hormone) implants were administered, resulting in an increase in oocyte diameter to 446–467 µm by November. Subsequently, three induced breeding trials were carried out using HCG and LHRHa hormones. Although two trials resulted in successful ovulation and egg stripping, fertilization attempts through artificial mixing with milt were unsuccessful. The mullets are currently being reared in a RAS-based system to obtain more mature broodstock for future trials.

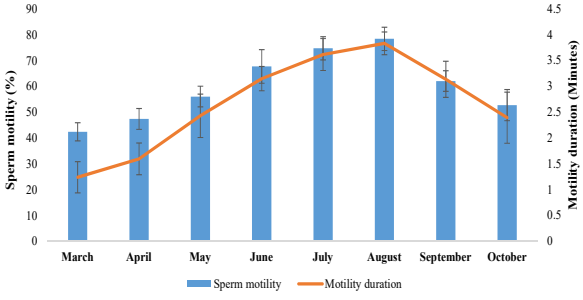
Maturing female of *Mugil cephalus*

Standardizing the breeding and larval rearing protocols of mangrove red snapper for mass scale seed production

Twelve mature brooders of mangrove red snapper (*Lutjanus argentimaculatus*) (females: 5–6 kg; males: 4.0-4.7 kg) were evaluated for captive breeding. Seasonal reproductive assessment revealed progressive gonadal maturation, with mean oocyte diameter increasing from 92.8 ± 6 µm during January-February to 507 ± 36 µm during August–September. Male maturation followed a similar trend, with milt release commencing in March. Sperm quality also improved seasonally, with motility increasing from 42% to 78% and sperm concentration from 1.4 × 10^9 to 3.6 × 10^9 ml^{-1} between March and August. Further, four breeding trials were conducted using HCG (1,500 IU kg^{-1} body weight) in females with oocyte diameter > 450 µm and oozing males. Successful spawning was achieved in two trials, yielding approximately 3.51 lakh eggs with 70% fertilization and 75% hatching rates. Larvae were successfully reared using rotifers, copepods, and *Artemia* nauplii. The results identified late July to early September as the optimal breeding period, coinciding with peak gonadal maturation.



Oocyte diameter (µm) of female *L. argentimaculatus* in different months

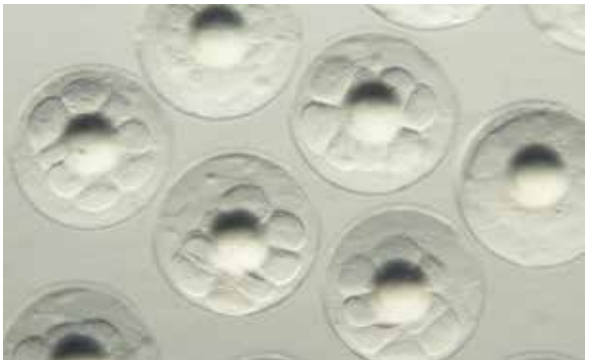


Motility and duration of *L. argentimaculatus* sperm during different months

Precocious maturation of Asian seabass and hatchery seed production

Asian seabass (*Lates calcarifer*) are protandrous hermaphrodites that first mature as males and typically change sex after 3-4 years, resulting in a shortage of males and unpredictable spawning in hatcheries. A hormone assited protocol using sustained-release GnRH analogue implants with either 17α-methyl testosterone (to induce spermiation) or 17β-estradiol (to promote early feminization) was applied monthly in PIT-tagged sub-adult seabass (1–1.7 kg, 42–50 cm) maintained in HDPE floating cages. Fish were fed trash fish at 4% body weight, and monitored for 10 months by biometric sampling, plasma steroid assays and cannulation of gonads. Treated males began milting after the third implantation, while females reached advanced ovarian stages (oocytes 410–444 µm) by the sixth. Six of eight induced spawning trials (June–September 2025) produced about 5,00,000 eggs, with 75–80% fertilization, 82.5% hatching and 35–40% larval survival, comparable to conventional large broodstock. The hatchery produced seeds were distributed to stakeholders.

Breeding pair of Asian seabass in RAS

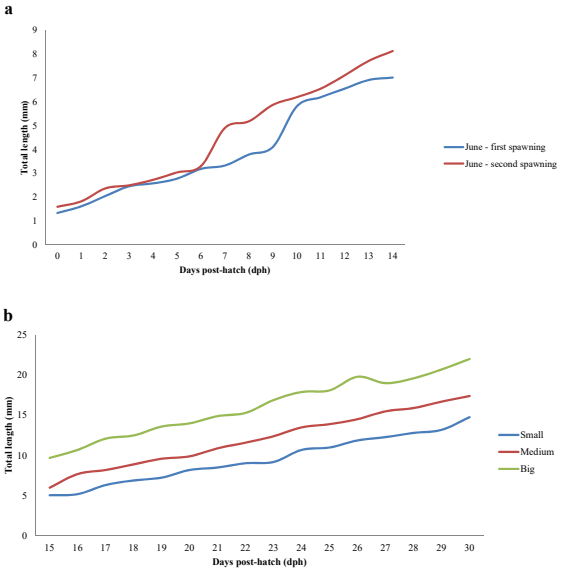


Developing embryo

Zero days post-hatch (dph) seabass larvae

30 dph seabass fry

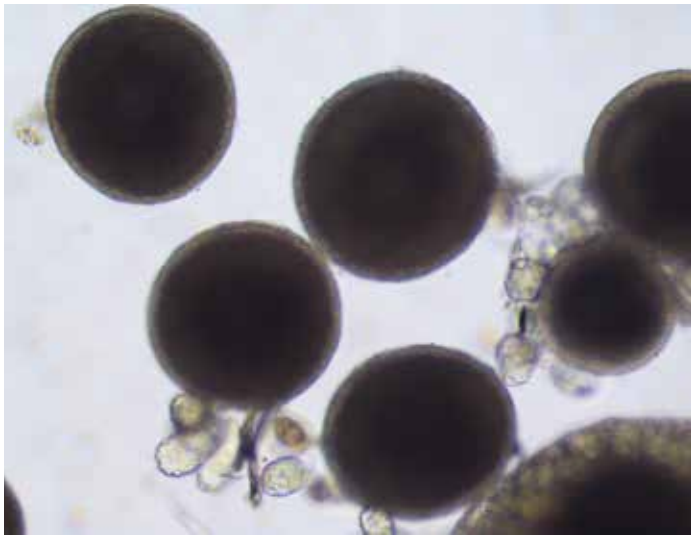
Nine-months-old F1 generation of Asian seabass from hormone-induced precocious brooders



(a). Growth comparison in first 14 days
(b). Differential growth in early fry stage of Asian seabass

Evaluation of hormonal induction protocols and spawning response in captive-conditioned goldlined seabream

As part of the broodstock development programme for goldlined seabream (*Rhabdosargus sarba*), ten juveniles (220–260 g) were collected in January 2025 and reared under captive conditions, attaining body weights of 480-650 g by September. Additionally, eight wild adults (650–870 g) were stocked in pond cages for broodstock conditioning. Regular feeding, environmental monitoring, and gonadal assessments were undertaken to evaluate reproductive readiness. By November 2025, 80% of the broodstock exhibited gonadal maturation. Four females with late-vitellogenic oocytes (460–510 µm) and seven oozing males were selected for induced breeding trials. Females were administered HCG at 1,000 IU kg^{-1}, followed by a resolving dose of 500 IU kg^{-1} in two fish, while males received 200 IU kg^{-1}. Brooders were transferred to a 10-ton recirculatory aquaculture system maintained at 26–27°C. Despite clear reproductive readiness, spawning was not achieved, possibly due to incomplete spawning synchronisation and suboptimal environmental cues.

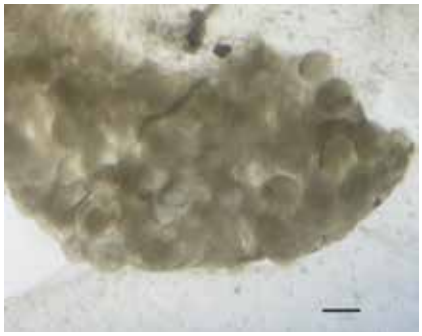


Oocytes of *Rhabdosargus sarba*

Hormone administration in *Rhabdosargus sarba*

Broodstock collection and gonadal maturity assessment of streaked spinefoot

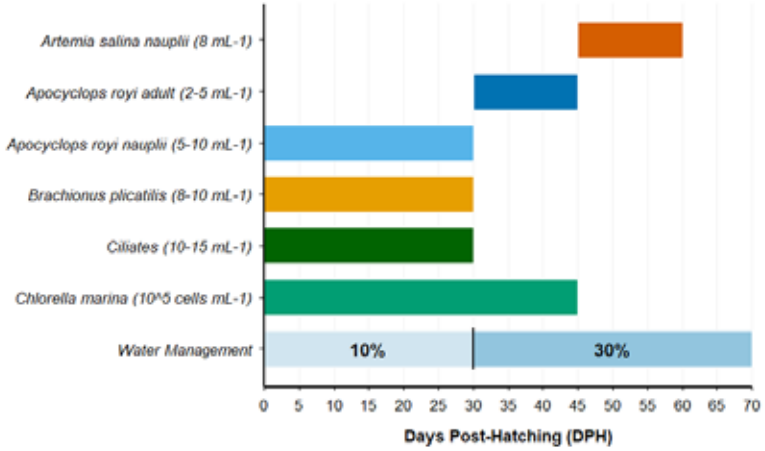
To strengthen broodstock development of streaked spinefoot (*Siganus javus*), 70 fish (28 individuals weighing 400-800 g and 42 individuals weighing 150–230 g) were collected from Pulicat, Kovalam, and Kanathur near Chennai and maintained in FRP tanks, cages, and recirculatory aquaculture systems (RAS). Fish were fed a formulated pellet diet twice daily, and growth and gonadal maturation were monitored under controlled water quality and photothermal conditions. For reproductive assessment, fish weighing 610-1230 g were sampled monthly to evaluate gonadal maturity, gonadosomatic index (GSI), and sex ratio. Maximum oocyte diameter (412 ± 1.6 µm) was recorded during March–June and October-November, with a female-to-male ratio of 1:1.6. Length at first maturity was estimated at 28.5 ± 3.6 cm for females and 25.7 ± 1.9 cm for males. Hormone pellets containing LHRH and 17α-methyltestosterone (50 µg kg^{-1} each) were implanted to accelerate maturation. Oocyte diameter increased from 82 ± 2.3 µm to 135 ± 4.2 µm after 30 days and to 158 ± 3.5 µm after a second implantation (65 days), compared with 98 ± 1.8 µm and 112 ± 2.7 µm, respectively in non-implanted fish.



Developing oocytes of *S. javus* (scale bar 400 µm)

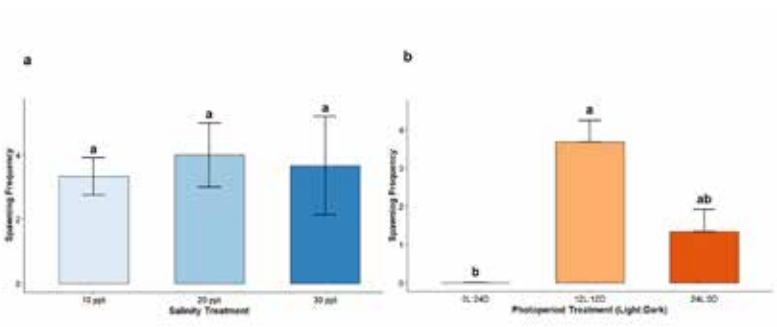
Closing the life cycle of mangrove pipefish in captivity: Broodstock management and standardization of larval rearing

Pipefish are specialized species found in freshwater, brackishwater and marine bodies of the world, closely related to seahorses. They are prized for their unique morphology in the ornamental trade and medicinal benefits. Brooders of mangrove pipefish, *Ichthyocampus carce,* were collected from the wild and maintained in a specialized RAS. During the study period, males were monitored for egg carrying in their brood pouches, indicating successful mating and fertilization in captivity. Courtship behaviour was recorded. Successful spawning was achieved through natural pairing and environmental manipulation of salinity (20 ± 2 ppt) and temperature (28 ± 2°C). The fertilized eggs were carried by the males until hatching occurred. Newly hatched pipefish larvae were stocked in indoor 100 Litre larval rearing tanks at a density of 2 larvae/L. A staggered feeding protocol was established using rotifers (*Brachionus plicatilis,* 10-15/ml) and copepod nauplii (*Apocyclops* sp, 10-15 / ml) and later transitioning to Artemia nauplii (*Artemia salina*, 2-5 /ml) to cater to their small mouth gape. After 34 days of intensive rearing, the larvae metamorphosed into juveniles.



Feeding protocol followed for *Ichthyocampus carce* larval rearing

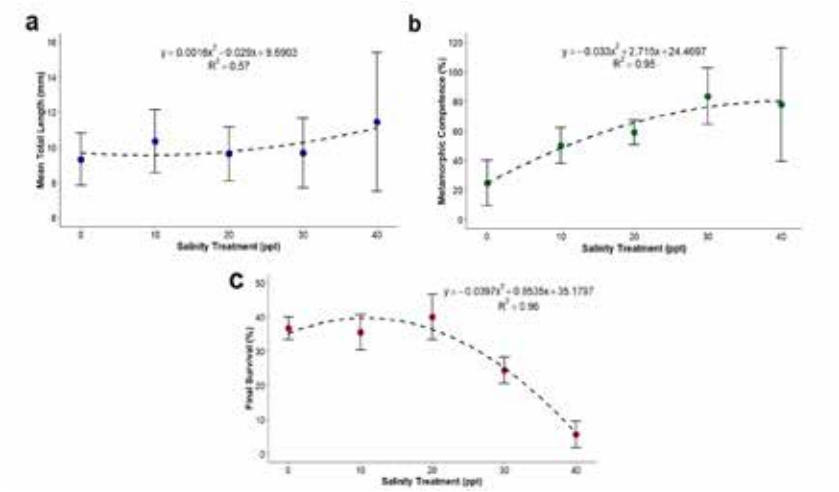
Juvenile of Mangrove pipefish *(Ichthyocampus carce)*



Spawning frequency of Mangrove pipefish under (a). different salinity and (b). photoperiod regimes

Impact of salinity on broodstock management, survival, growth, and larval metamorphosis of the brackishwater tiger goby

The tiger goby (*Mugilogobius tigrinus*) is an emerging brackishwater ornamental fish with high potential in the aquarium trade. To standardize captive broodstock management and larval rearing protocols, a salinity trial (0, 10, 20, 30, and 40 ppt) was conducted with broodstock (somatic growth and physiological well-being) and larvae (pre- and post-metamorphic performance). Fulton's condition factor remained stable across treatments, demonstrating strong acclimation and euryhalinity. Body proportions were consistent across all salinities, indicating physiological adaptability. Specific growth rate remained near zero at 20–30 ppt, suggesting an optimal shift of metabolic energy toward gonadal development and reproductive readiness. Second-order polynomial regression revealed a strong relationship between salinity and larval survival (R^2 = 0.96), with maximum survival occurring at intermediate salinities (10–20 ppt) and declining at higher salinities. Metamorphic success also showed a strong polynomial response (R^2 = 0.95), reaching 77–83% at 30–40 ppt, indicating that elevated salinity accelerated ontogenetic transition. Larval growth in total length was moderately associated with salinity (R^2 = 0.57). Salinity of 20–30 ppt is optimal for broodstock management, and 20 ppt for hatchery rearing of *M. tigrinus*.



(a). Growth, (b). Larval metamorphosis and (c). Survival of *Mugilogobius tigrinus*

Broodstock management and standardization of induced spawning protocol for green puffer fish

Green puffer fish (*Tetraodon fluviatilis*) is a prized ornamental species found in the brackishwater bodies of the Sundarbans which is highly sought after in the ornamental fish trade. Broodstock of body weight ranging from 50 - 300 g were maintained in floating cages at KRC, ICAR-CIBA. During June 2025, the fish were acclimatized to two higher salinity levels, 15 and 20 ppt, in a recirculating aquaculture system. Hormonal induction was performed using LHRHa to induce ovulation. Females were induced with LHRHa at a dose of 70 µg/kg body weight, while males were given 50 µg/kg body weight. Ovulation occurred 72 hours after hormone administration with fecundity in the range of 50,000 to 1,20,000 eggs/female. The fertilized eggs were demersal, translucent, contained numerous oil droplets and measured 690 to 720 µm in diameter. Hatching began 80 hours post-fertilization (hpf) and continued until 100 hpf. Newly hatched larvae measured between 2.0 and 2.1 mm in length.

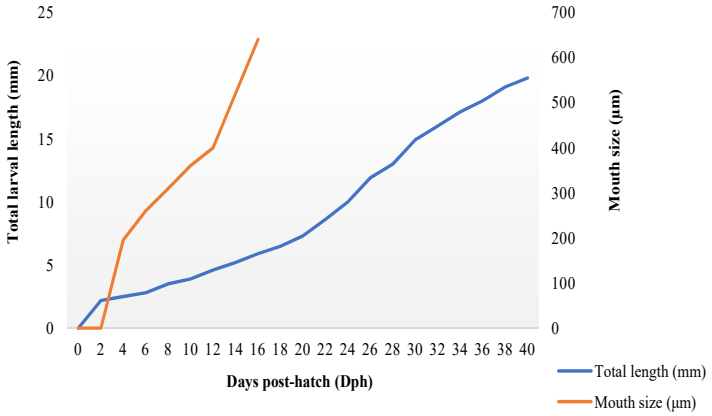
Adult green puffer fish (*T. fluviatilis*)

Fertilized eggs of green puffer fish

Newly hatched green puffer fish larvae

Standardization of indoor larval rearing protocol for green puffer fish

To standardize the larval rearing protocol of green puffer fish (*Tetraodon fluviatilis*), feeding experiments were conducted with a combination of live feed. Mouth openings were observed (Total length: 160 ± 5 µm) on 3 dph at 24 - 26 °C in newly hatched larvae of *T. fluviatilis*. Larvae were stocked at a density of 15-20 larvae/L in a larval rearing tank filled with filtered seawater (salinity: 20 ppt) and microalgae. Yolk reserves were observed to last until 5 dph. Rotifer (*Brachionus plicatilis*) was provided in LRT from 3-15 dph, with density maintained at 10 - 20 nos./ml. Further, during 11-20 dph, copepods were provided. Later, larvae were weaned to *Artemia* nauplii (density: 3-5 nos./ml) during 15 - 30 dph. Weaning to formulated feed (CP-42%) commenced from 30 dph onwards. After 40 days of indoor nursery rearing, the larvae reached a marketable size of 2.0 cm. Around 172 fry were produced with total survival rate of 20.11 ± 5.63 % from the first batch of spawning which can fetch ₹ 20–30/ piece in the local ornamental fish market.



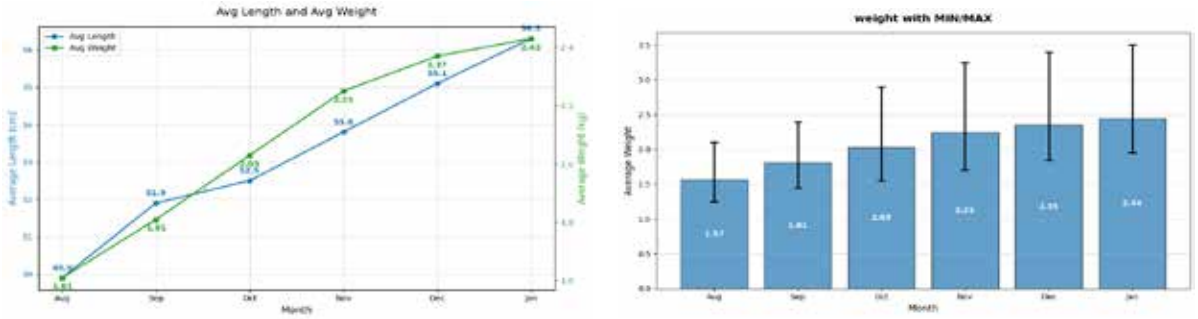
Larval growth for green puffer fish (*Tetradon fluviatilis* Hamilton, 1822)

Thirty days old green puffer fish fry

Green puffer fish juveniles

Asian seabass maturation with hormonal priming and indigenous feed

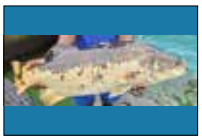
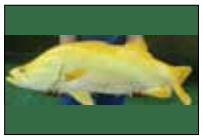
During May–June 2025, 97 sub-adult Asian seabass (1.5-2.0 kg) were procured from High Tide Aqua Farm, Sirkazhi. Following quarantine and screening, 72 fish confirmed negative for Viral Nervous Necrosis (VNN) were stocked in earthen ponds and fed ICAR-CIBA's Seabass Brood*plus* feed. Over a 210-day culture period, the fish attained an average body weight of 3.4 kg while maintained in water with 22-25 ppt salinity. To accelerate maturation, fish were allocated to hormonal treatment and control groups. Seventeen α-methyltestosterone (MT) implants were administered to 34 fish at doses of 3 (22 nos.) or 5 (12 nos.) mg/kg body weight. Two additional groups (12 fish each) received combined GnRH + E2 or GnRH + MT hormone treatments (50 µg/kg body weight each). Early maturation responses were observed, with two males from the GnRH + MT group attaining maturity in November and one female from the control group maturing in December. The study demonstrated the successful development of mature male and female seabass broodstock in captive ponds using specialized Seabass Brood*Plus* feed and hormonal interventions.



Growth of pond reared seabass broodstock fed with Seabass Brood*Plus* feed

Study of colour morphometry in Asian seabass

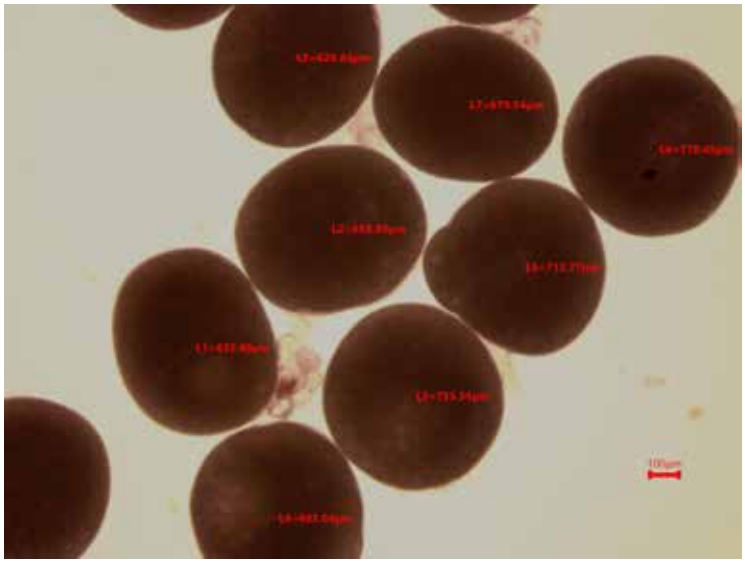
Sub-adult Asian seabass with distinct colour modifications, specifically golden-yellow, mixed, pale white, and yellow-spotted, were sourced from commercial ponds. They were reared in cement tanks to monitor potential changes in their colouration over time. The variations in colour changes, progressive and reversing, were recorded with photography. In the picture plate with tag nos. 3503, specimens initially exhibited mixed colour, which progressively transitioned to pale white and ultimately to yellow during subsequent sampling. Further, specimens with tag nos. 3501, 3481, and 3543 showed a colour shift from bright yellow to light yellow, followed by the emergence of black spots. This indicates a reversal toward its original natural colouration.

Tag No	May	July	October	January	March
3503					
3501					
3481					
3543					

Changes in colour pattern in Asian seabass

Captive maturation of hilsa in earthen ponds

Broodstock of hilsa (*Tenualosa ilisha*) (age > 2 years) were maintained in earthen ponds at KRC and fed a formulated diet (CP: 36.64%; EE: 13.11%). Two months prior to the breeding season, fish were provided with a functional broodstock feed (CP: 42.5%; EE: 14.5%) to enhance gonadal development. Brooders were tagged using 8 mm PIT tags (Biomark) for monitoring maturation status. Gonadal development was assessed through biopsy during October-November, revealing that about 80% of tagged females attained maturity, with oocyte diameters ranging from 551 to 684 µm. In males, milt quality showed a motility score of 3, with sperm remaining active for 2-3 minutes post-activation and a sperm density of 5.38 × 10^9 cells. These results demonstrate the successful maturation of hilsa broodstock under pond-based conditions.



Oocyte diameter of mature female hilsa in pond systems during October - November

Spawning attempts of hilsa in pond and RAS systems under different salinities

Four captive breeding trials were conducted during October-November in ponds and RAS at salinities of 0–3 ppt. Females with oocyte diameters of 671-686 µm and milting males were selected. Induced breeding was carried out using a GnRHa-based synthetic hormone at 0.5 ml/kg body weight for females, with males receiving half the dose. Dry stripping was attempted in hydrated females maintained in brackishwater (3 ppt) after 10 hours of hormone induction; however, fertilization was not successful. Females transferred to freshwater post-induction survived up to 16 hours, during which oocyte diameter increased from 686 µm to 780.5 µm, indicating continued maturation under altered salinity conditions.

Mature female hilsa from pond systems during October - November before hormone induction

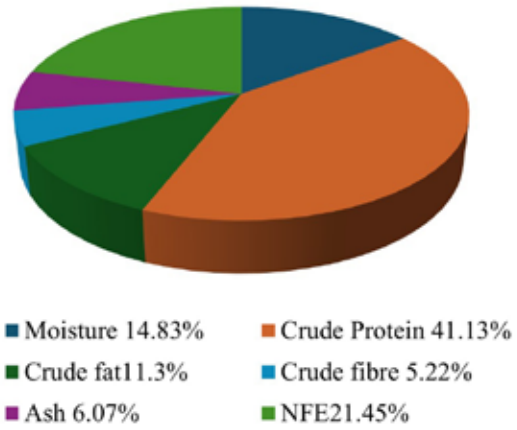
03

Nutrition and Feed Technology

Nutrition and Feed Technology

Rice dried distillers grain soluble as potential ingredient in shrimp feeds

A 60-day feeding trial was conducted to evaluate rice distillers dried grains soluble (DDGS) as a replacement for soybean meal in the diet of *Penaeus vannamei*. A total of 360 shrimp (initial weight: 3.93 ± 0.09 g) were randomly assigned to four dietary treatments, each with three replicates of 30 shrimp. Four isonitrogenous and isolipidic diets (36% crude protein and 5.8% lipid) were formulated with rice DDGS included at 0, 10, 20, and 30%, replacing soybean meal at 0, 33, 66.7, and 100%, respectively. Results showed no adverse effects on feed attractability, acceptability, or palatability. Final body weight, weight gain, feed conversion ratio (FCR), and survival did not differ significantly among treatments. Histopathological examination of the hepatopancreas revealed normal tissue structure across all groups. The findings demonstrated that rice DDGS can completely replace soybean meal in *P. vannamei* diets without compromising growth performance, feed utilization, health status, hepatopancreatic integrity, or body composition, highlighting its potential as a cost-effective alternative protein source.



Proximate composition of Rice DDGS

Golden and purple sweet potato meal as an alternate resources of feed ingredient

Nutrient analysis was performed for golden and purple sweet potatoes obtained from ICAR-CTCRI. Both varieties of sweet potato possess a good amount of available carbohydrates and have potential as a source of energy in place of conventional cereals like wheat and maize. They can be used as an alternative to rice bran in herbivorous fishes. The byproduct tuber chips, sweet potato, and weevil-infested sweet potato also have been screened and the results revealed that these materials are rich sources of readily available carbohydrates and have the potential to replace conventional energy sources such as maize and wheat in feed formulations.

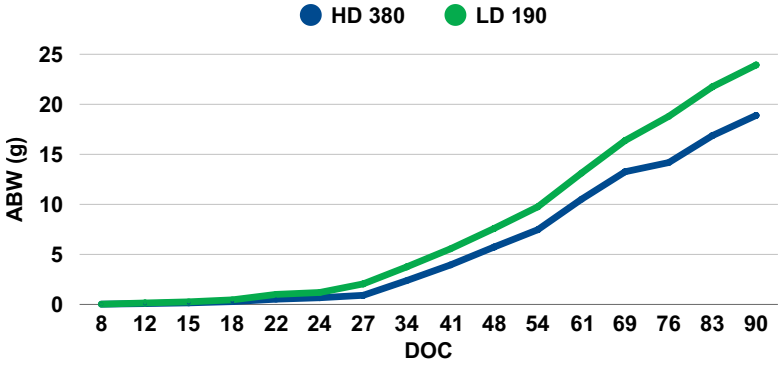
Proximate composition (%) of Golden and Purple Sweet Potato

Nutrient (%) / Sample	Golden sweet potato	Purple sweet potato
Moisture	7.85	7.17
Crude protein	15.48	15.61
Ether extract	2.45	3.84
Total ash	13.7	11.03
Acid insoluble ash	2.26	2.62
Crude Fibre	24.53	29.74
NFE	35.99	32.61

Golden and Purple sweet potato used as an energy and colour enhancing functional ingredient

Effect of dietary protein levels on growth performance of whiteleg shrimp under SIPNSF System

A 106-day feeding trial was conducted under super intensive, precision and natural shrimp farming (SIPNSF) tank-based culture conditions at a stocking density of 240 shrimp/m³ to evaluate the effects of dietary protein levels on the growth performance of *Penaeus vannamei*. Two diets were tested: a low-protein (LP, 31%) and a high-protein (HP, 36%) formulation. Average body weight (ABW) followed a similar trend in both treatments during the first 35–40 days of culture, indicating comparable early growth. However, from mid-culture onwards, shrimp fed the HP diet exhibited consistently higher growth rates, with a clear divergence after 50 days of culture. At harvest (106 DOC),



Growth performance of shrimp fed two different dietary protein levels under SIPNSF

shrimp receiving the HP diet attained a higher final ABW (21 g) than those fed the LP diet (20 g). Although the growth advantage was moderate, the results indicate that higher dietary protein can enhance growth under SIPNSF conditions. Economic analysis showed that feed cost significantly influenced production costs, highlighting the need to optimize dietary protein levels to balance biological performance and economic efficiency in SIPNSF-based shrimp culture systems.

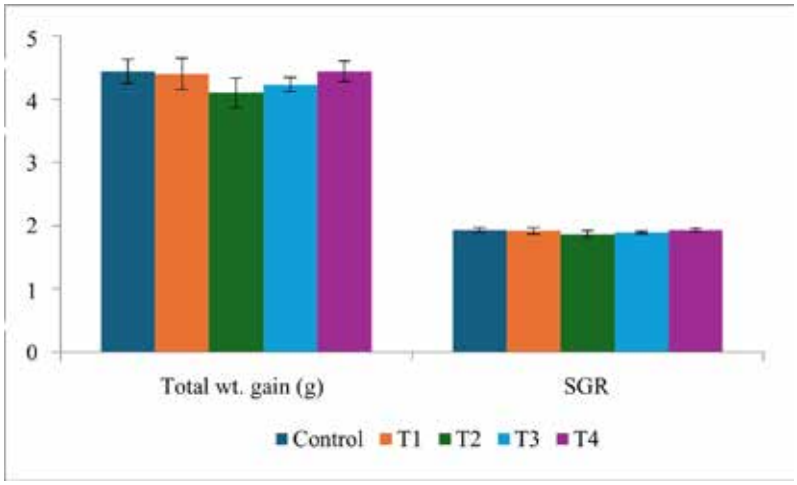
Performance of Pacific white shrimp fed zero fishmeal diet supplemented with BSF meal

A 110-day feeding trial was conducted in six circular tanks (150-ton capacity, in triplicate) under SIPNSF protocols, stocking *Penaeus vannamei* juveniles (1.5 g) at 150 shrimp/m³. The experimental diet replaced 100% fishmeal in the Vanami Plus (10%) formulation using 7% black soldier fly (BSF) meal along with plant protein sources. Shrimp fed the BSF-based, fishmeal-free diet showed superior performance, achieving higher survival (86% vs. 70%) and biomass yield (1,007 kg vs. 907 kg) compared to the fishmeal-based control. Feed efficiency remained comparable, with a slightly improved FCR (1.39 vs. 1.40). Although individual weight gain was marginally higher in the control (18.78 g vs. 16.93 g), the overall results demonstrate that BSF meal is a viable and sustainable alternative protein source for shrimp diets in SIPNSF systems without compromising performance.

Shrimps produced with BSF meal replacing fishmeal in SIPNSF

Effects of feeding ration and intermittent day feeding on growth indices of Whiteleg Shrimp

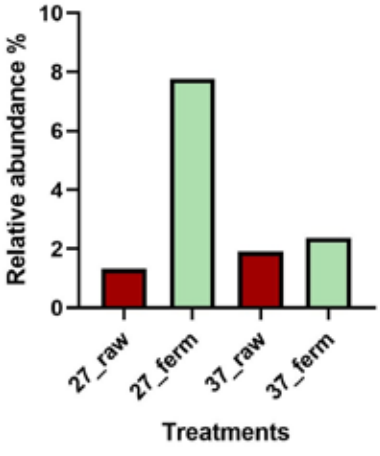
An experiment was conducted to delineate the effects of varying feeding rations and alternate/ intermittent day feeding on the growth performance, survival rate, and body composition of Whiteleg Shrimp, (*Penaeus vannamei*). The study was carried out in 300 L circular FRP tanks with a stocking density of 60 post-larvae per m^3. The trial followed a complete randomised design with three replicates for a 90-day period, using Chingudi ^{Plus} feed as per the biomass of each FRP tank. The five treatment groups included: control (100% feeding ration), T1 (90% feeding ration), T2 (80% feeding ration), T3 (80% and 100% feeding ration on alternate days), and T4 (70%, 70%, and 100% feeding ration on alternate days). The results of the study showed a non-significant difference in growth performance among the treatment groups. The 70%-70%-100% feeding ration (T4) on alternate days showed similar growth performance as of control indicating that reduced ration and intermittent feeding could be adopted for profitable farming of White leg shrimp.



Effects of feeding ration and intermittent day feeding on growth performance of Whiteleg Shrimp

Dietary fermented soybean meal modulates gut microbial diversity and composition in Whiteleg shrimp

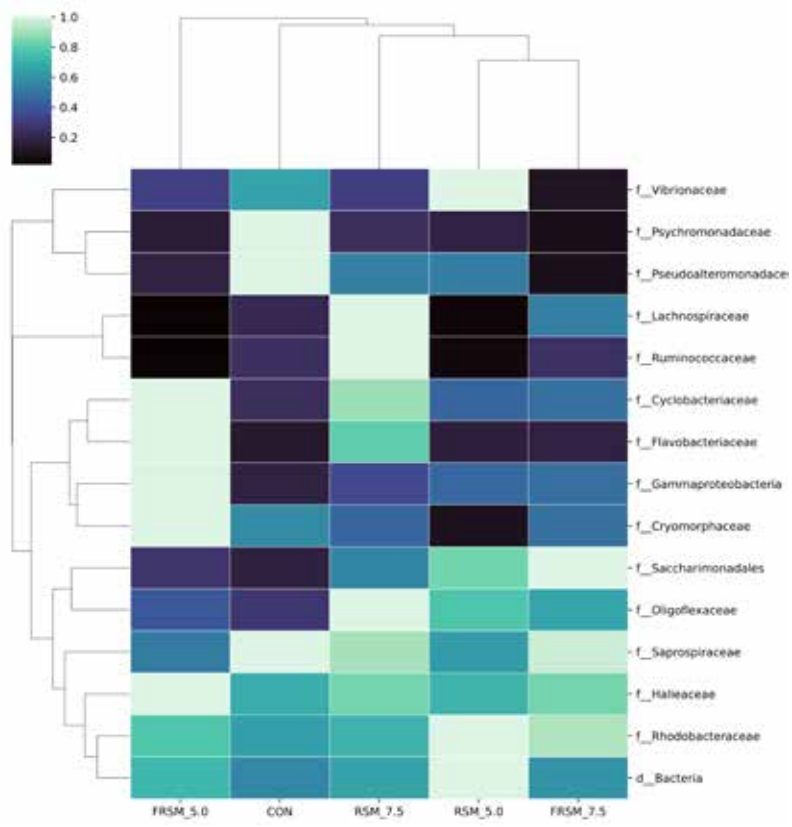
The present study investigated the effects of raw and fermented soybean meal on the gut microbial profile of *Penaeus vannamei* at two dietary inclusion levels (27% and 37%). The Phylum Proteobacteria constituted more than 70% of the total phyla, followed by Bacteroidetes. The relative abundance of the genus *Shimia* increased in the fermented groups, indicating the enrichment of beneficial bacteria with metabolic capabilities to produce diverse bioactive compounds that contribute to host adaptation and defence mechanisms. Differential abundance analysis using ANCOM-BC further demonstrated that fermentation selectively enriched beneficial taxa. In particular, the genus *Weissella* was significantly enriched at the 37% fermented soybean inclusion level. As an important probiotic in the shrimp gut, *Weissella* may contribute to enhanced immune responses and improved digestive efficiency. These findings suggest that solid state fermented soybean meal offers a practical strategy to partially replace fish meal inclusion in the diets of *P. vannamei*.



Effect of dietary inclusion of fermented soybean meal on the probiotic bacteria, *Shimia* sp. in *P. vannamei*

Manipulation of gut microbiome by feeding fermented rapeseed meal for high health Whiteleg shrimp

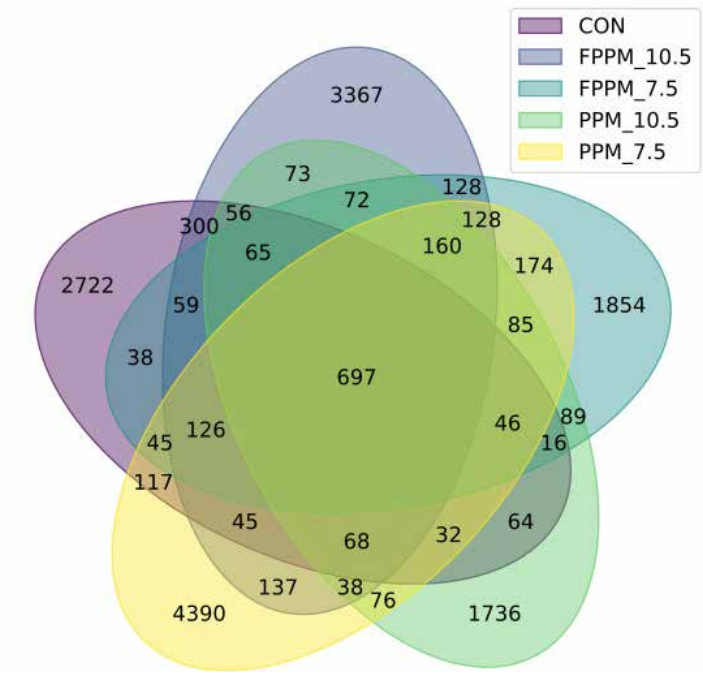
Rape seed meal (RSM) was fermented with *Bacillus subtilis* and *Saccharomyces cerevisiae* to ameliorate antinutritional factors and enhance its nutritional value. Fermentation increased the levels of limiting amino acids lysine, methionine, and tryptophan by 19.66%, 17.18%, and 10.91%, respectively. Five experimental diets were prepared with 0%, 5%, and 7.5% levels of raw and fermented RSM. Shrimp fed fermented RSM exhibited lower levels of *Vibrionaceae*, a family of significant disease-causing bacteria, compared to those fed unfermented or control diets. *Firmicutes* and *Bacteroidetes* are both involved in the fermentation process, contributing various nutrients to the host, particularly short-chain fatty acids, which increase with the feeding of fermented RSM. The inclusion of fermented RSM improved gut microbiome diversity (Simpson, Shannon, Fisher, Chao1), enhancing gut health, functional stability, and disease resistance.



Effect of feeding fermented RSM on gut microbiome

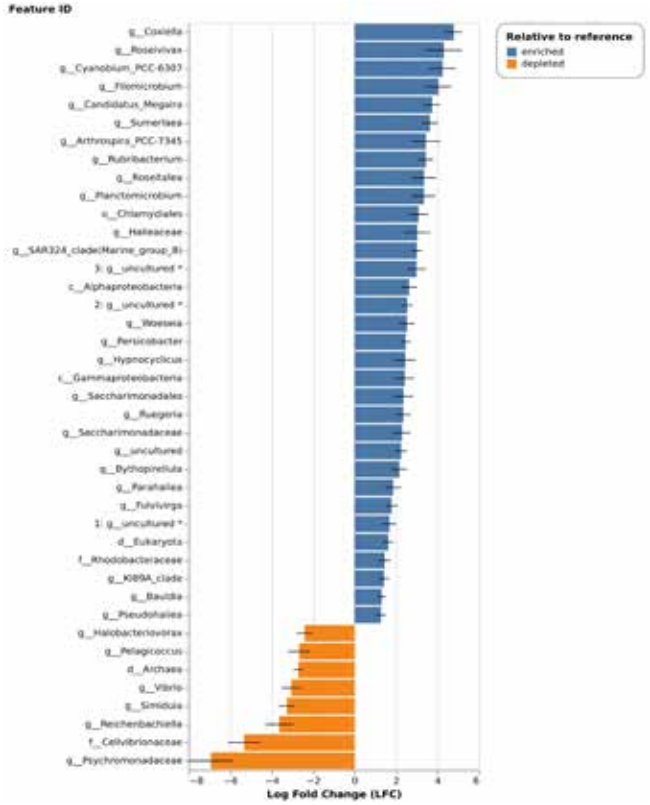
Effect of dietary microbial fermented plant protein mix replacing fishmeal on the gut microbiota of Whiteleg shrimp

Evaluated the effects of a dietary microbial fermented plant protein mix (FPPM) on the gut microbiota of *Penaeus vannamei*. The plant protein mix was prepared using soybean meal, groundnut oil cake, rapeseed meal, and sunflower oil cake in a ratio of 6:3:2:1. The PPM was fermented using *Bacillus subtilis* and *Saccharomyces*



Venn diagram representing the number of shared and unique ASVs in shrimp fed with fermented plant protein mix.

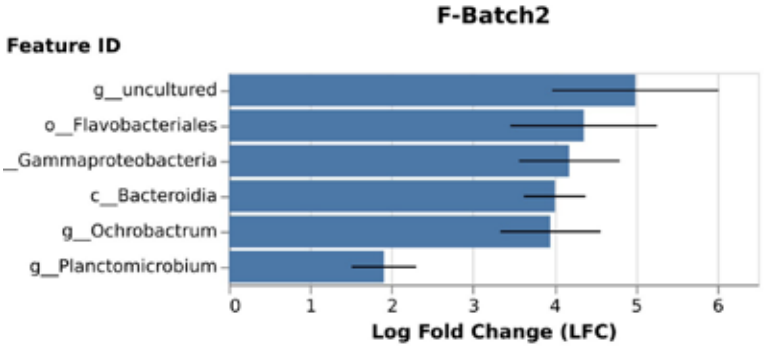
cerevisiae for three days at 34°C in a 150 L capacity pilot scale solid-state fermenter. Shrimps were fed five isonitrogenous diets: a control diet containing 15% fishmeal (FM), PPM-7.5 and FPPM-7.5 (replacing 50% of FM), and PPM-10.5 and FPPM-10.5 (replacing 70% of FM). The relative abundance of beneficial phyla, including Bacteroidota and Actinobacteria, was higher in the fermented diet groups. Bacteroidota possess specialized polysaccharide degradation systems that enable efficient carbohydrate utilization. Actinobacteria produce diverse beneficial metabolites, antibiotics, and bioactive compounds. These findings suggest that microbial fermentation of plant protein sources promotes a more favourable gut microbial profile.



Differential abundance of enriched and depleted ASVs in *P. vannamei* gut fed the CON and fermented plant protein mix diets, by ANCOM-BC (Log-fold change values).

Influence of dietary protein quality on the gut microbial and metabolic pathways in Whiteleg shrimp

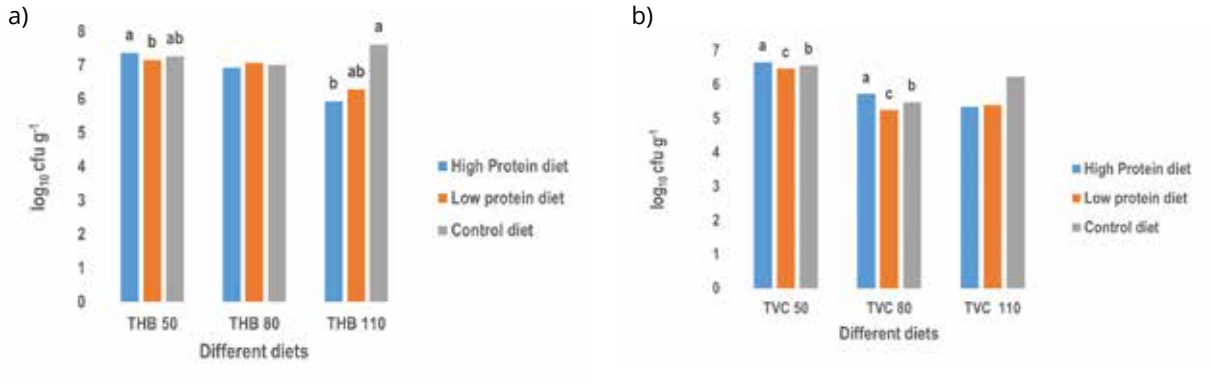
The quantity and quality of the dietary protein affects shrimp growth. The present experiment studied the influence of dietary protein quality on gut microbiome and metabolic pathways. This study employed a combination of *Bacillus subtilis* and *Saccharomyces cerevisiae* for fermentation in a pilot-scale fermenter. Three isonitrogenous (34% CP) diets were prepared: a control diet without fermentation and two fermented diets labelled Batch 1 (72 hrs) and Batch 2 (96 hrs). Fermentation has significantly increased the essential amino acids, thereby altering the quality of the protein. ANCOMBC analysis showed significantly higher enrichment of *Flavobacteriaceae*, *Gammaproteobacteria*, *Bacteroidia*, and *Ochrobactrum* in the fermented group. Transcriptome sequencing analysis identified 61 differentially expressed genes (DEGs) that were upregulated in both fermented feed groups (Batch 1 and Batch 2) compared to the control group. Furthermore, KEGG pathway enrichment analysis revealed that the FB-2 group exhibited significant enrichment in metabolic pathways like protein digestion and absorption, carbohydrate digestion and absorption, and pancreatic secretion.



Effect of protein quality on gut microbiome enrichment in shrimp, *P. vannamei*

Effect of varying protein diets on bacterial dynamics in the gut and rearing water of Whiteleg shrimp in SIPNSF system

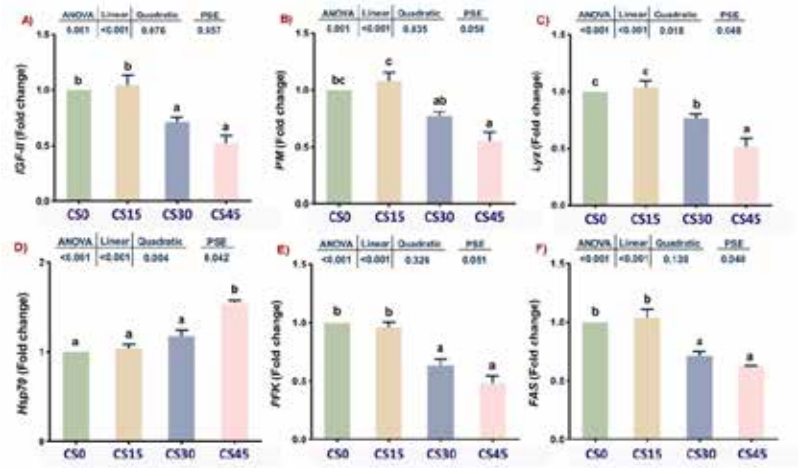
Microbial dynamics of the rearing water and gut of the *Penaeus vannamei* at 50, 80, and 110 days of culture was studied in the SIPNSF system supplemented with low protein, high protein, and control diet. The total heterotrophic bacterial (THB) and total vibrio count (TVC) in shrimp gut and rearing water were recorded. Bacterial diversity of the shrimp gut revealed that diet type and culture stage significantly alter microbial community load. THB counts were significantly *(P<0.05)* higher in the high-protein diet at 50 DOC;however, by 110 DOC, the counts were significantly higher in the control diet. TVC in the gut of *P. vannamei* was significantly influenced by dietary protein levels during the early and mid-culture phases. At 50 and 80 DOCs, TVC was significantly *(P<0.05)* higher in shrimps fed a high-protein diet compared to low protein and control diets. However, by 110 DOC, no significant difference in total vibrio counts in gut was observed among the dietary treatments. Further, there was no significant difference in the THB and TVC in the rearing water.



Effect of varying protein diets on bacterial dynamics in the gut a) Total heterotrophic bacterial count b) Total vibrio count

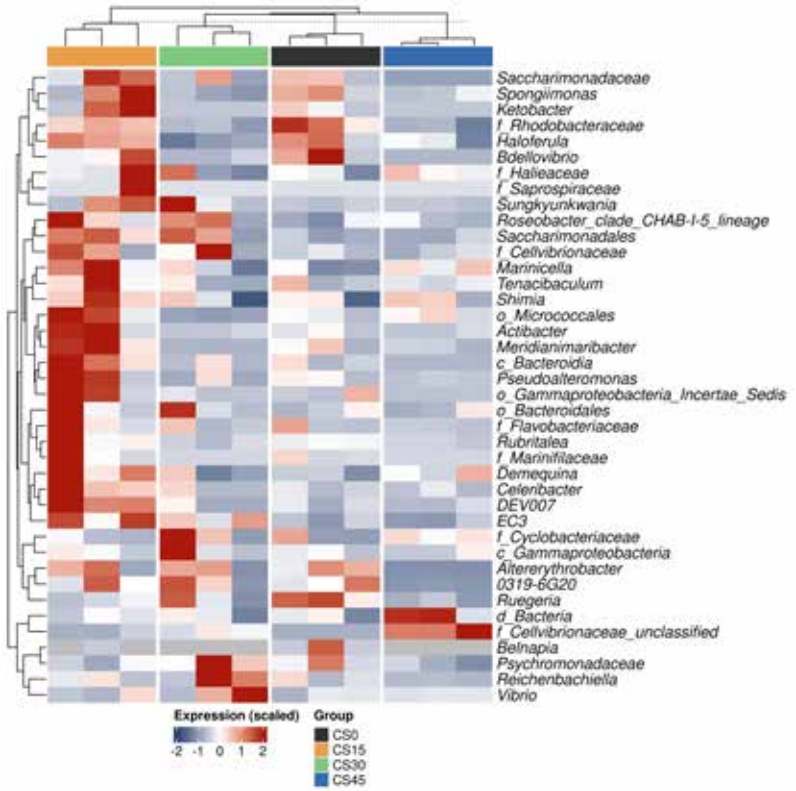
Effect of cotton seed meal, in the diet of Whiteleg shrimp on growth-related gene expression and gut microbiome

Evaluated cottonseed meal (CSM) as a partial replacement for fishmeal and other dietary ingredients in feeds for *Penaeus vannamei*, with particular emphasis on its effects on growth performance and intestinal microbiota. Four isonitrogenous (37% CP) and isolipidic (6% EE) diets were formulated containing 0%, 15%, 30%, and 45% CSM and were fed to shrimp for 60 days. Shrimp fed CS0 and CS15 exhibited comparable growth performance and feed conversion ratio. Increasing CSM inclusion significantly downregulated growth- and metabolism-related genes like insulin-like growth factor II (*IGF-II*), paramyosin (*PM*), phosphofructokinase (*PFK*), and fatty acid synthase (*FAS*) in *P. vannamei*. Intestinal microbiota analysis revealed that CS0 and CS15 maintained



Relative expression of hepatopancreatic genes in *P. vannamei* fed diets containing 0% (CS0), 15% (CS15), 30% (CS30), and 45% (CS45) cottonseed meal for 60 days. (A) IGF-II, (B) PM, (C) Lyz, (D) HSP70, (E) PFK, and (F) FAS.

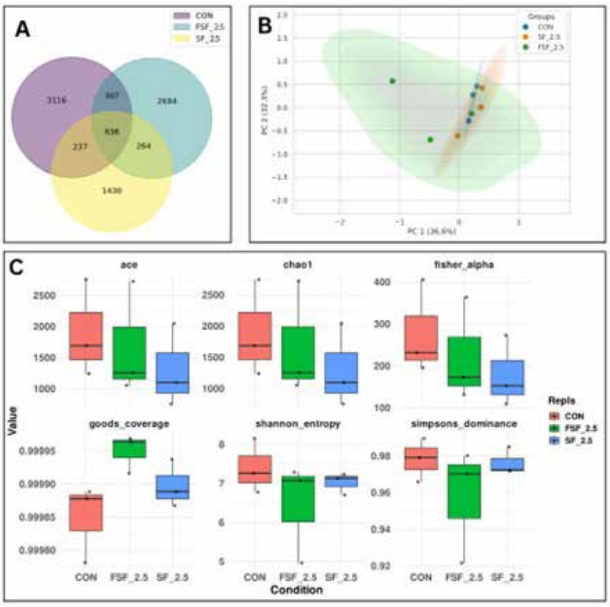
higher microbial diversity and community stability, whereas higher CSM inclusion reduced diversity and promoted fibre-degrading Bacteroidota and opportunistic genera such as *Vibrio*.



Heatmap of the relative abundance of the top 40 bacterial genera in the intestinal microbiota of *P. vannamei* fed diets containing graded levels of cottonseed meal diets (CS0- control; 0% CSM; 15% CSM; 30% CSM; 45% CSM) over a 60-day feeding trial.

Effect of dietary inclusion of fermented sunflower oilcake on growth, immunity and gut microbiome in Whiteleg shrimp

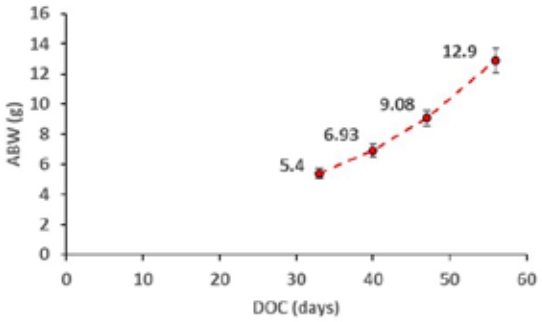
The potential of microbial fermented sunflower oilcake (FSF) as a functional ingredient in the diets of *Penaeus vannamei* was evaluated. Commercial SF was fermented using *Bacillus subtilis* (10^9 CFU mL^{-1}) and *Saccharomyces cerevisiae* (10^8 CFU mL^{-1}) for three days at 34°C in a pilot-scale fermenter. Juvenile shrimp (1.86 ± 0.01 g) were fed three isonitrogenous diets, viz., control diet (CON), diet with 2.5% raw sunflower oilcake (SF-2.5), and diet with 2.5% fermented sunflower oilcake (FSF-2.5) for 56 days. Nutritional analysis indicated that fermentation increased crude protein and essential amino acid contents, while reducing fibre and antinutritional factors. Shrimp fed with the FSF-2.5 diet showed significantly higher weight gain and daily growth coefficient, and a lower FCR. Gut microbiota analysis revealed that shrimp fed with FSF-2.5 diet showed higher relative abundance of potential probiotic bacterial groups, viz. *Fulvivirga*, *Ruegeria*, and *Shimia*, while reducing the pathogenic *Pseudomonas*. The findings demonstrated the role of FSF as gut health promoter and a sustainable functional feed ingredient for shrimp aquaculture.



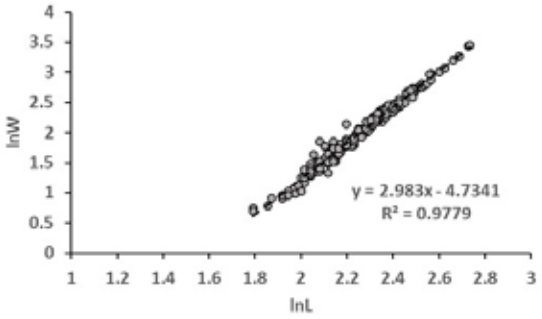
Diversity and richness of gut microbiota in *P. vannamei* fed CON, SF-2.5, and FSF-2.5 diets.
A) Venn diagram representing the number of shared and unique ASVs
B) PCoA analysis on the basis of Bray–Curtis distance
C) Alpha diversity indices.

Evaluation of the cost-efficient feed, Chingudi^{plus} in *P. vannamei* farming in the West Coast

A farming trial was carried out at Navsari, Gujarat, to evaluate the feasibility of Chingudi^{plus} feed on the West Coast. Nursery-reared shrimp (ABW ~ 0.05 g) were stocked in a 4000 m^2 earthen pond at 25 nos/m^2 and fed Chingudi^{plus} feed of varying sizes according to the shrimp size in the pond. The shrimp attained a mean body weight of 12.90 g by 56 days. The weekly growth rate ranged from 1.53 to 2.97 g/week with a mean of 2.21 g/week. A total production of 1,047 kg was achieved after 57 days, with a survival rate of 92.1% and an FCR of 1.06. The length-weight relationship of shrimp in the experimental pond was $W=0.008791L^{2.983021}$, R^2:0.9779 ($p<0.0001$). The shrimp displayed a negatively allometric growth pattern as seen in most fast-growing penaeid shrimp, and the relative condition factor, K_n, was greater than 1 (K_n:1.0031), indicating good condition of the shrimp. The trial provides preliminary validation of Chingudi^{plus} for use in shrimp farming along the west coast.



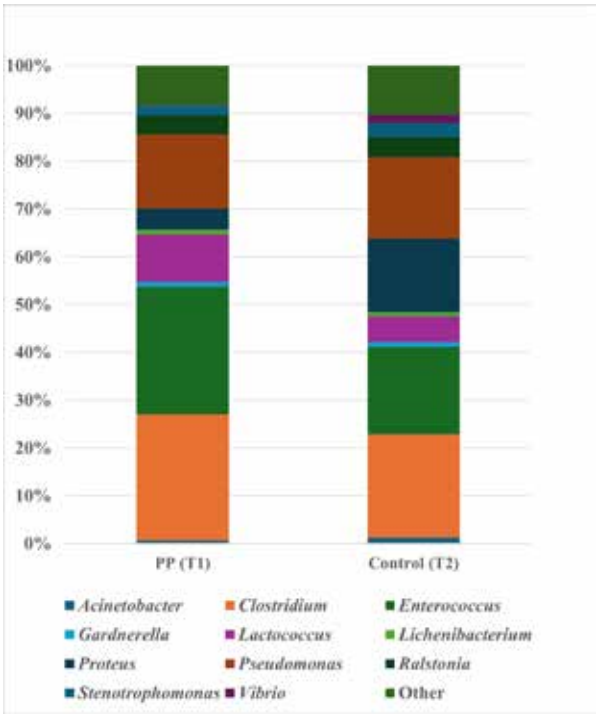
Average body weight of *P. vannamei* during different sampling intervals in an earthen pond fed using cost efficient white shrimp diet, Chingudi^{plus}.



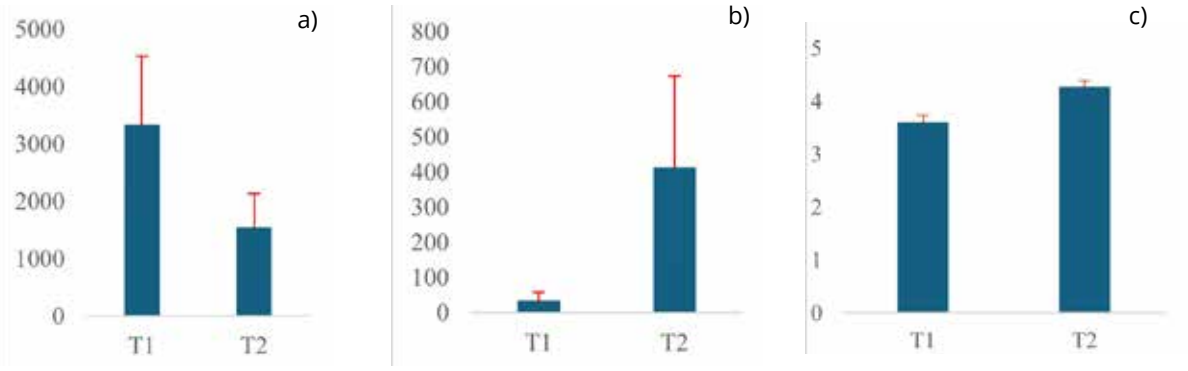
Length weight relationship (LWR) of shrimp fed using a cost-efficient white shrimp diet, Chingudi^{plus} at the end of 56 days of grow-out trial.

Microbial diversity of pond water and gut of whiteleg shrimp gut and pond water during shrimp farming using Plankton^{Plus} and Chingudi^{Plus} feed

Bacterial diversity in the cultured shrimp (*P. vannamei*) gut was carried out using metagenomics based on the V3-V4 region of the 16S rRNA gene, while cultured using Plankton^{Plus} and Chingudi^{Plus} feed (T1), and using commercial feed along with conventional practices (T2). The dominant bacterial genus in the shrimp gut for both groups was found to be *Acinetobacter*, *Clostridium*, *Enterococcus*, *Pseudomonas*, *Lactococcus*, *Gardenerella*, *Lichenibacterium*, *Proteus*, *Ralstonia,* and *Stenotrophomonas*. The relative abundance of *Lactococcus* spp, which is considered as a beneficial bacteria, is significantly higher in the case of T1 as compared to T2. On the other hand, the relative abundance of *Vibrio* spp. was significantly lower in T1 as compared to T2 ($P < 0.05$). The total heterotrophic bacteria (THB) and total *Vibrio* (TV) were monitored in cultured water and haemolymph of shrimp. No significant differences in the levels of THB and TV were observed in cultured water. However, the TV level in haemolymph was significantly higher in T2 than in T1 ($P > 0.05$).



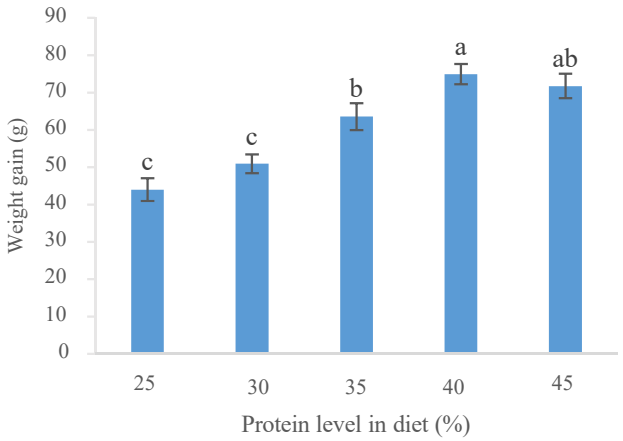
Relative abundance of different bacterial genus in the shrimp gut in T1 (Plankton^{plus} and Chingudi^{plus}) and Control (T2)



Relative abundance of bacteria in whiteleg shrimp gut during shrimp farming using Plankton^{Plus} and Chingudi^{Plus} feed
a) Relative abundance of *Lactococcus* spp. in shrimp gut
b) Relative abundance of *Vibrio* spp. in shrimp gut
c) *Vibrio* load in haemolymph

Optimization of dietary protein requirement for juvenile blue swimmer crab

A 90-day feeding experiment was conducted to determine the optimal dietary protein level for improving growth and feed efficiency of juvenile blue swimming crabs reared in individual plastic crab boxes. Five pellet diets containing crude protein levels of 25, 30, 35, 40, and 45% were evaluated using juveniles' crab with an initial average body weight of 8.14 g. Growth parameters such as final body weight, weight gain, weight gain percentage, specific growth rate (SGR), moulting frequency, feed conversion ratio (FCR), and survival were recorded. Results indicated a progressive improvement in growth and feed efficiency with increasing dietary protein levels. Crabs fed 40 % protein diets exhibited higher weight gain, SGR and moulting frequency, along with lower FCR values, beyond which increasing protein to 45% did not improve growth. The study demonstrates that a dietary protein level of 40% is optimal for promoting growth and feed efficiency in juvenile blue swimmer crabs.



Weight gain of juvenile blue swimming crabs fed pellet diets containing crude protein levels of 25, 30, 35, 40, and 45%.

Development of seaweed-based pellet feed for blue swimmer crab

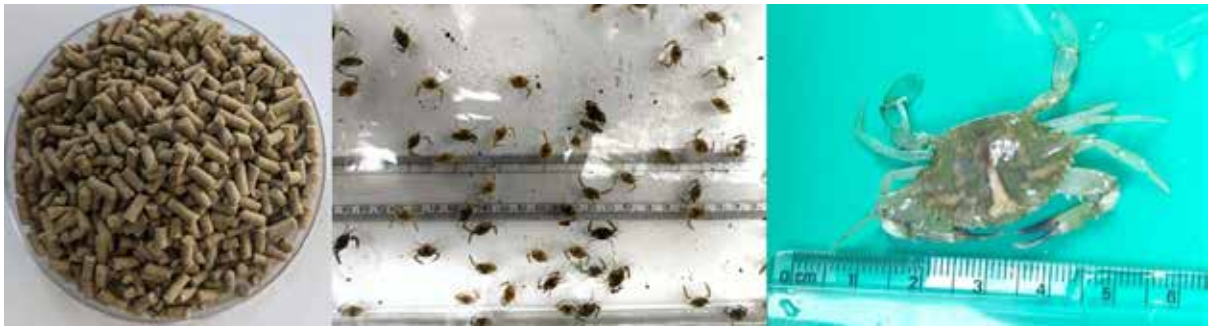
The use of marine macroalgae as functional feed ingredients has gained attention in aquaculture because of their mineral-rich and bioactive properties. In this context, the present work aimed to develop and standardize a seaweed-based pellet feed for blue crab using the red seaweed *Gracilaria salicornia*. Fresh seaweed collected from lined pond was thoroughly washed, solar dried, and pulverized to obtain fine powder. The processed seaweed powder was analyzed for mineral composition and proximate composition to evaluate its nutritional suitability as a feed ingredient. *G. salicornia* exhibited appreciable levels of essential macro- and trace minerals, including calcium, magnesium, sodium, iron, manganese, zinc, iodine, and sulphur. Proximate

analysis revealed moderate crude protein content (9%), low lipid levels (<1%), high total ash content (47%), and moderate fiber, highlighting its mineral-rich functional characteristics. Based on these attributes, crab feeds were formulated with graded inclusion levels of G. salicornia at 0% (control), 1%, 2%, and 3% and prepared into pellets using a pelletizer for blue crabs.

Development of *Gracilaria salicornia* based pellet feed for blue crab a) Fresh seaweed, b) solar-dried material, c) seaweed powder, and d) formulated pellets.

Standardization of feeding rate for early juvenile blue swimmer crab

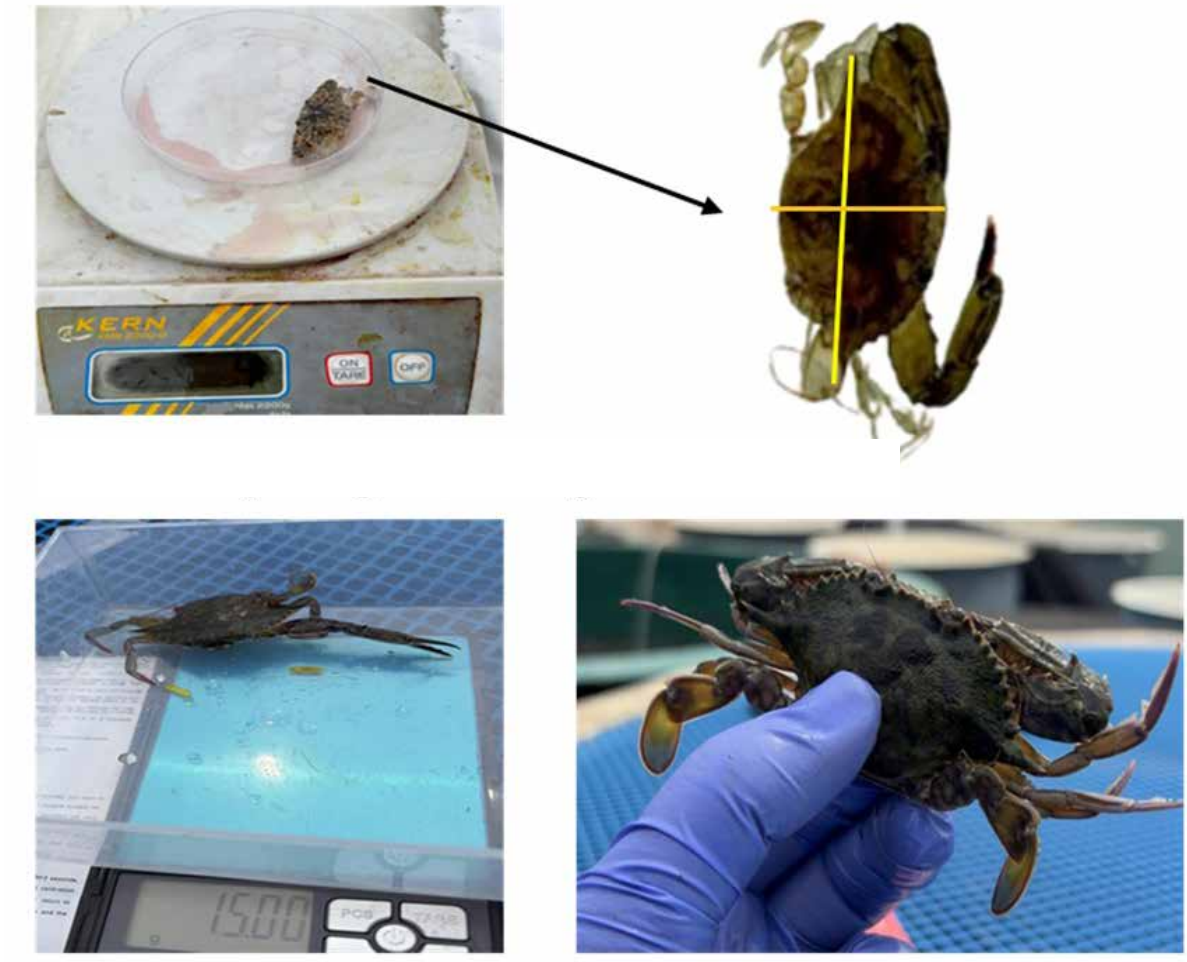
A feeding rate standardization study was undertaken for early juvenile blue swimmer crab with the objective of improving growth, moulting, and feed utilization during nursery rearing. Juveniles with an initial mean body weight of about 1.05 g were reared for 42 days and fed formulated pellet diets at 7.5, 10, 12.5, and 15% of initial body weight, while a separate group was fed live clam meat. Growth performance, moulting frequency, specific growth rate, and feed conversion ratio were evaluated. Pellet-fed crabs exhibited a progressive improvement in growth and moulting frequency with increasing feeding rate up to 12.5%, beyond which no marked improvement was observed. The lowest feed conversion ratio was recorded at the 12.5% feeding rate, indicating superior feed utilization. Live clam feeding resulted in higher growth and moulting, but showed comparatively higher wet-weight feed conversion ratio. Based on overall performance, a pellet feeding rate of 12.5% of body weight was standardized for nursery rearing of early juvenile blue swimmer crab.



Pellet feed and early juvenile blue swimming crabs used for feeding rate standardization study

Biofloc based culture of blue swimmer crab with three different dietary regimes

A biofloc based culture of blue swimming crab was carried out with three different dietary regimes for 45 days experiment in a 500-liter tanks. Fifteen crablets of *Portunus reticulatus* were stocked in each tank and assigned to the following treatments such as: control, Cibafloc + trash fish (T1), Cibafloc + clam meat (T2), and Cibafloc + cibafeed (T3). The biofloc densities were maintained up to 2-5 ml/L for all the treatments. The obtained results showed that the higher growth rate in T2 (18.65 gm) with a CL of (2.85 cm) and CW of (5.82 cm) treatment as compared to other treatment groups. Crablet rearing in the biofloc might have increased the survival and helped in the reduction of cannibalism. Further, analysis of tissue biochemical profile and THB was performed at the end of the experiment.



Sampling of blue swimming crab with three different dietary regimes in biofloc based culture

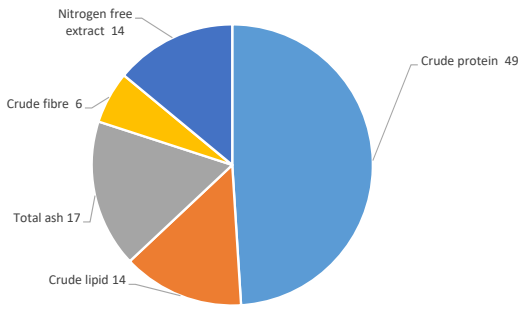
Optimising the dietary protein requirement of tiger goby

Mugilogobius tigrinus, a hardy goby species, has shown a strong potential for brackishwater aquaculture. Successful captive maturation, breeding and larval rearing have been achieved at ICAR-CIBA. Consequent to this success of seed production, feed development for this species assumes considerable importance. In this context, it is essential to determine the optimal nutrient requirement for growth and health. Protein being an important nutrient, a study was conducted to optimize the protein requirement in the diet of *M. tigrinus*. Five diets containing 25, 30, 35, 40, and 45% protein were prepared in a Spheronizer as 500- and 800-micron pellets and used for a feeding trial. The results of the feeding experiment revealed that the optimal protein requirement for tiger goby would be around 35-40%.

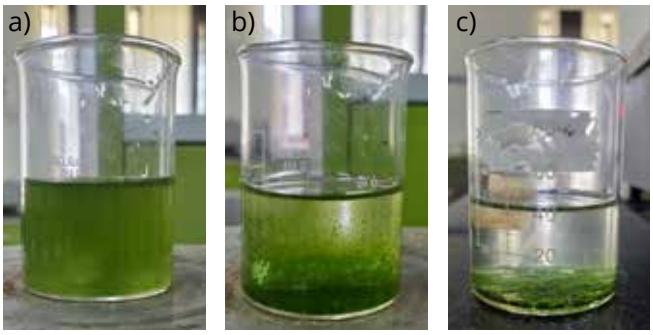
Mugilogobius tigrinus, a hardy goby species has shown a strong potential for brackishwater aquaculture

Mass production of microalgae, copepods in controlled conditions, and Microalgae Harvesting

Research facility was developed at Muttukadu Experimental Station of the Institute for research and mass production of microalgae, rotifers, copepods, and *Artemia*, and for their application in finfish and shellfish larval rearing. High-density production of cyclopoid copepods was standardized using a mixed microalgal diet, with continuous harvesting of nauplii through a filtration system. The produced copepod nauplii were successfully utilized in the larval rearing of brackishwater ornamental fishes such as *Mugilogobius tigrinus*, *Mangarinus waterous,* and *Ichthyocampus carce*. Nutritional profiling of calanoid copepods revealed high protein (49%) and lipid (14%) contents in the biomass. In another study, flocculation of small-sized microalgae (*Tetraselmis* spp. and *Chlorella* spp.) was standardized using chitosan, achieving more than 95% flocculation efficiency within 20 minutes as an eco-friendly alternative to chemical flocculants.



Proximate composition of calanoid copepod biomass



Flocculation using chitosan at different time intervals a) 5 minutes, b)10 minutes and c)20 minutes

Design and evaluation of a modular tray-based rearing system for polychaete biomass production

A standardized tray-based rearing methodology was developed for controlled biomass production of polychaetes under laboratory conditions. The system employs plastic trays of dimensions 42 × 27 × 14 cm with an optimized vertical configuration comprising a 7 cm sediment layer, a 2 cm overlying water column, and a 5 cm freeboard. Drainage was provided at one end of each tray and fitted with a mesh net to facilitate controlled water exchange while preventing the escape of polychaetes and loss of sediment. This design facilitated natural burrowing behaviour and efficient water management. The methodology was validated through stocking density trials. Increasing stocking density from 50 individuals per tray to 300 individuals per tray resulted in a gradual decline in individual final weight. In contrast, total biomass exhibited a positive response to increasing stocking density. The system enabled precise control of feed input and growth monitoring.

Design and biomass production in modular tray-based rearing system a) Tray-based polychaete rearing system b) Biomass production of polychaetes in trays

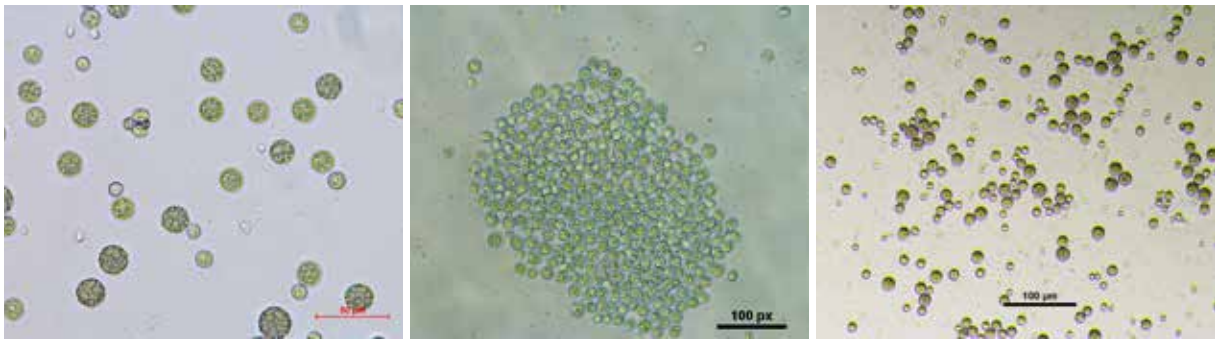
Optimization of dietary fat level for growth and feed utilization in polychaete culture

A study was undertaken to optimize the dietary fat level for improving growth performance and feed utilization in polychaete culture under controlled conditions. *Perinereis nuntia* with a uniform initial body weight of 0.04 g per individual were stocked in a tray-based rearing system, and all dietary treatments were maintained in triplicate. Formulated diets containing graded fat levels of 4, 7, 10, and 13% were evaluated. Polychaetes fed the lower dietary fat levels recorded the highest final weight, weight gain, biomass, and specific growth rate, along with the lowest feed conversion ratio. Higher survival across all dietary treatments, indicating that dietary fat levels within the tested range did not influence survival. The results indicates that dietary fat level affected growth performance and feed utilization efficiency in polychaetes.

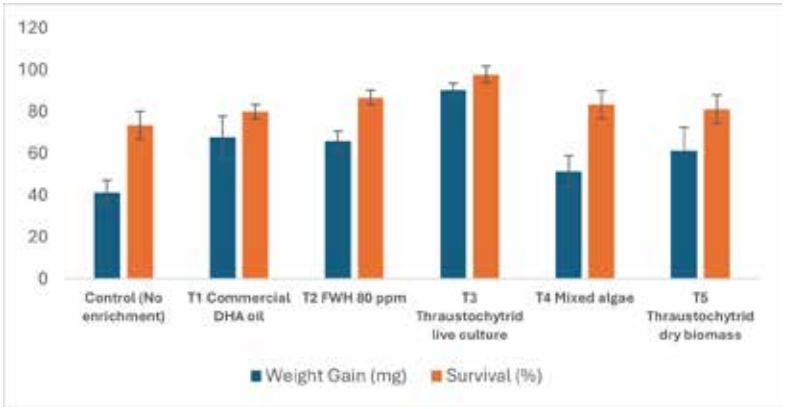
Cultured polychaetes obtained from dietary fat level treatment under tray-based rearing conditions

Thraustochytrid-enriched live feeds improve survival rates of pearlspot larvae

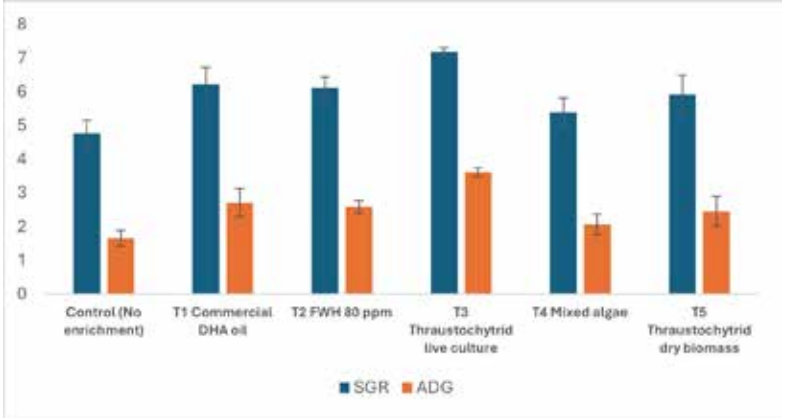
Thraustochytrids are heterotrophic microalgae rich in lipids, especially docosahexaenoic acid (DHA), which is vital for the growth and survival of fish larvae. To study the prospects, a potent strain, *Aurantiochytrium aceptoplyllum*, was isolated from decaying Rhizophora leaves in the Pichavaram mangroves and cultured under heterotrophic conditions glucose–yeast–peptone medium. Growth optimization revealed that 25 ppt salinity yielded maximum biomass, with lipid and protein contents of 43.71% and 37.77%, respectively. A 25-day feeding trial using *Etroplus suratensis* larvae compared *Artemia* nauplii enriched with different sources, including commercial DHA, fish waste hydrolysate, mixed microalgae, and both live and dry biomass of *A. aceptoplyllum*. Larvae fed with *A. aceptoplyllum*-enriched *Artemia* showed significantly higher weight gain (90.3 ± 3.32 mg) and survival (97.77 ± 3.72%). These findings highlight the strong potential of *Aurantiochytrium*-enriched live feed as an effective and nutritionally superior strategy for enhancing larval performance in aquaculture systems.



Different Thraustochytrid species isolated from Pichavaram mangrove ecosystems



Weight gain and survival percentage of *E. suratensis* larvae fed with enriched *Artemia*



Specific growth rate and Average daily gain of *E. suratensis* larvae fed with enriched *Artemia*

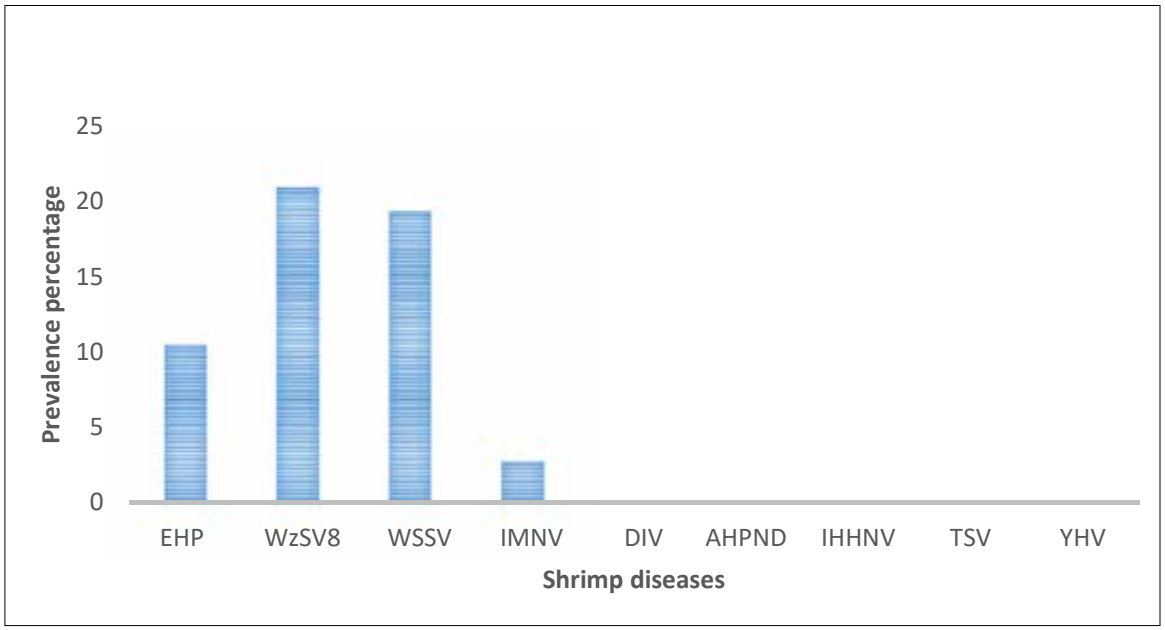
04

Aquatic Animal Health Management

Aquatic Animal Health Management

Prevalence of WOAH-listed and emerging pathogens in Indian shrimp farms

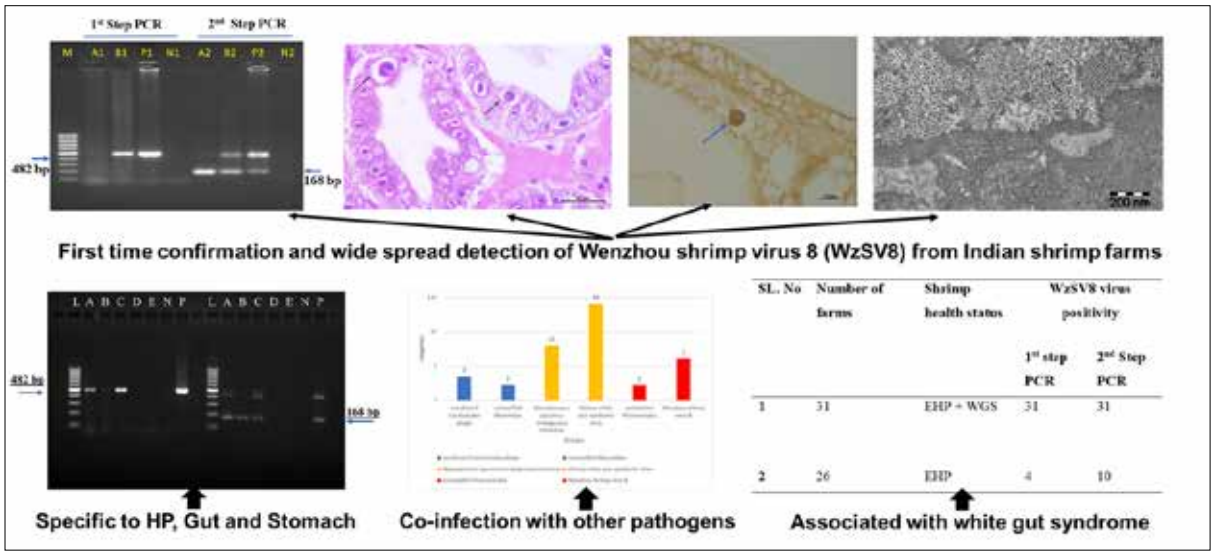
Shrimp disease surveillance for WOAH-listed and other pathogens was carried out in 152 farms across the country, from shrimp-producing states such as Tamil Nadu (N=68), Gujarat (N=59), Andhra Pradesh (N=8), Odisha (N=7), West Bengal (N=8), and Kerala (N=2). The prevalence of WSSV, EHP, IMNV, and Wenzhou shrimp virus 8 was 19%, 10.5%, 2.8%, and 21%, respectively. Although WSSV and EHP were reported in all of the surveyed states, the incidence of WzSV8 was limited to Tamil Nadu. The study also confirmed the isolation of 24 bacterial species mainly, *V. alginolyticus*, *V. parahaemolyticus*, *V. coralliilyticus*, *V. mediterranei*, *V. owensii*, and *Photobacterium damselae,* through 16S rRNA sequencing. The findings indicate that viral pathogens continue to pose significant threats, while secondary bacterial infections may contribute to disease complexity and farm-level losses.



Prevalence of shrimp diseases across aquaculture farms in different regions of the country

Widespread detection of Wenzhou shrimp virus 8 (WzSV8) in cultured shrimp farms

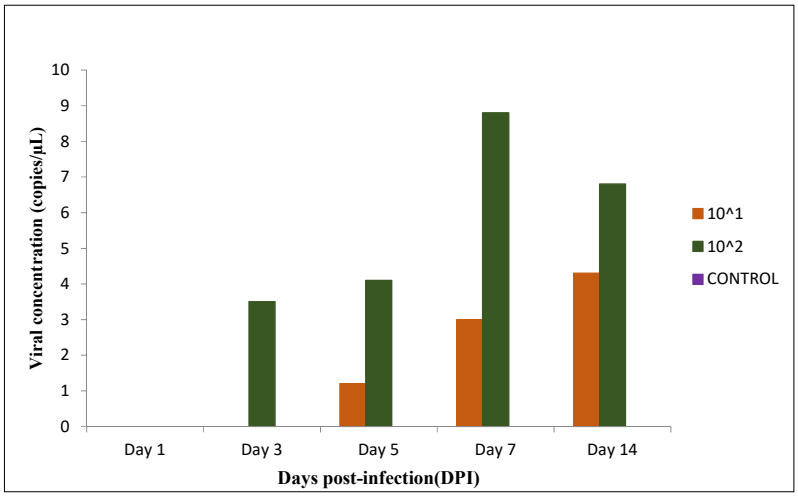
An attempt was made to investigate the presence of a newly described shrimp virus, Wenzhou shrimp virus 8 (WzSV8). About 200 *Penaeus vannamei* samples from different locations in India were collected and analysed. Widespread detection of WzSV8 was observed with 58% of samples testing positive. While many samples contained only WzSV8, co-infections with other shrimp pathogens, including WSSV, IMNV, and EHP, were also observed. The presence of the WzSV8 virus was confirmed through PCR, histopathology, *in situ* hybridization, transmission electron microscopy, and transcriptomics. Only hepatopancreas, gut, and stomach tested positive for the virus, whereas muscle and gill were negative. A strong correlation of WzSV8 with shrimp white gut syndrome (WGS) was observed. Phylogenetically, the Indian virus isolates were more closely related to Chinese isolates. However, the role of this virus in disease manifestation or in precipitating the pathological conditions through co-infection requires further investigation.



First report and confirmation of Wenzhou shrimp virus 8 (WzSV8) infection in Indian shrimp farms.

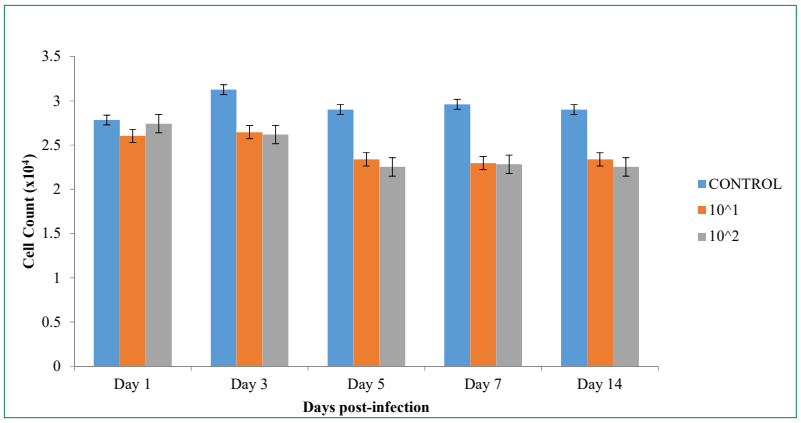
Dose-dependent immune modulation in WSSV-infected shrimp

An experimental study investigated the molecular and cellular inflammatory responses during WSSV infection in *P. vannamei* (N = 180). Shrimp were divided into three groups and injected with 10^1 or 10^2 WSSV viral copies, while controls received PBS. Gill, hemolymph, and pleopod samples were

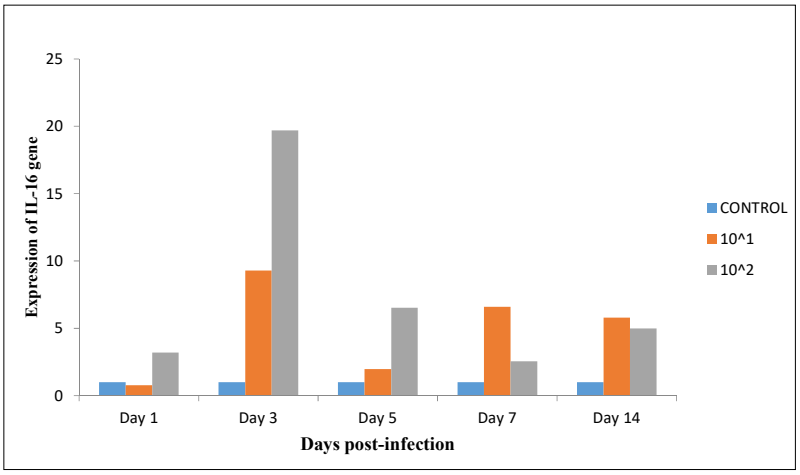


Relative viral load in *P. vannamei* challenged with different concentrations (10^1 and 10^2 copies) of WSSV at various dpi

collected at 1, 3, 5, 7, and 14 days post-infection (dpi). Viral load analysis revealed dose-dependent replication, with a sharp increase between 5 and 7 dpi, particularly in the 10^2 group, followed by partial stabilization at 14 dpi. Total hemocyte count (THC) showed progressively depleted as infection advanced, with greater reduction in the higher-dose group, indicating dose-dependent immune modulation. IL-16 expression was upregulated early in the 10^2 group and peaked at 7 dpi, correlating with maximal viral replication. A lower viral dose resulted in delayed but sustained infection. Overall, the higher viral inoculum induced earlier, stronger viral proliferation and pronounced inflammatory and cellular immune responses than the lower dose infection.



Total haemocyte count (THC) in *P. vannamei* following experimental infection with 10^1 and 10^2 WSSV viral copies at different dpi



Relative mRNA expression levels of IL-16 in *P. vannamei* following experimental challenge with 10^1 and 10^2 WSSV viral copies at different dpi

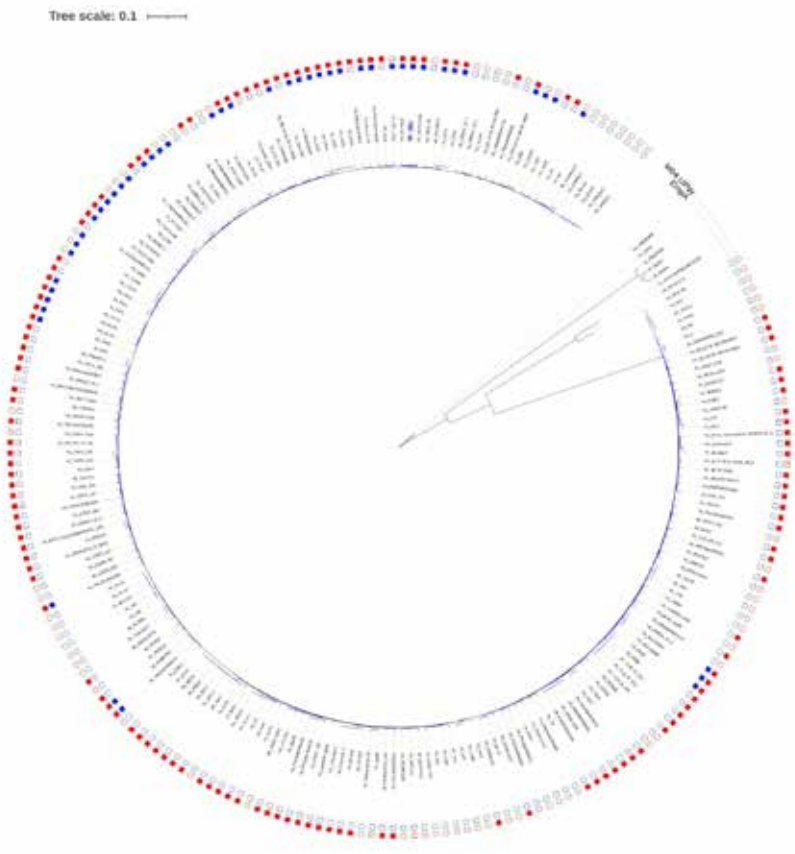
Investigation of Running Mortality Syndrome (RMS) in shrimp farms of Nagapattinam district of Tamil Nadu

Running mortality syndrome (RMS), reported earlier in 2011, has recently caused severe, substantial cumulative mortalities leading to premature harvests and production losses. A comprehensive investigation aimed at identifying the aetiology and associated risk factors through systematic clinical, laboratory, and epidemiological investigation is being undertaken in collaboration with Rajiv Gandhi Centre for Aquaculture (RGCA) and Prawn Farmers Federation of India (PFFI). As part of the investigation, a retrospective epidemiological survey was conducted in the 119 shrimp farms in the Nagapattinam district to assess the prevalence, seasonal trends, and geographical clustering. Spatial analysis indicated a widespread and uniform distribution of RMS across the region, with prevalence up to 60%. Preliminary economic analysis estimated the revenue loss due to RMS at ₹ 8.04 lakhs per hectare and production loss of 1.86 tonnes/ha.

Sampling for Running Mortality Syndrome (RMS) investigation project in shrimp farm at Nagapattinam

Core and accessory virulence factors deciphered in *Vibrio harveyi*

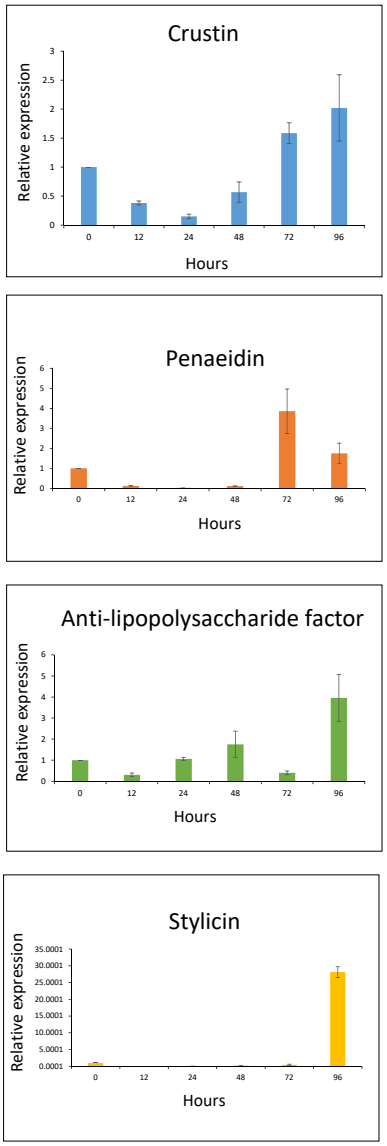
Comparative genomic analysis of 216 *V. harveyi* genomes revealed that the species possesses a highly conserved genome, with nearly 80% of the gene pool forming the core genome. Within this conserved framework, several core virulence determinants were identified, including multiple secretion systems such as type II, type III, and type V secretion systems, which are essential for host interaction, toxin secretion, and pathogenicity. In contrast, certain virulence-associated factors exhibited variability among strains. These accessory elements included the EmpA metalloprotease, type IV secretion systems, and plasmids, suggesting differences in virulence potential and adaptive strategies among isolates. Further analysis showed that the distribution of these variable virulence factors was associated with host origin, geographic location, and phylogenetic lineages. Overall, these findings provide valuable insights into the genomic conservation and virulence diversity of *V. harveyi* in aquaculture environments.



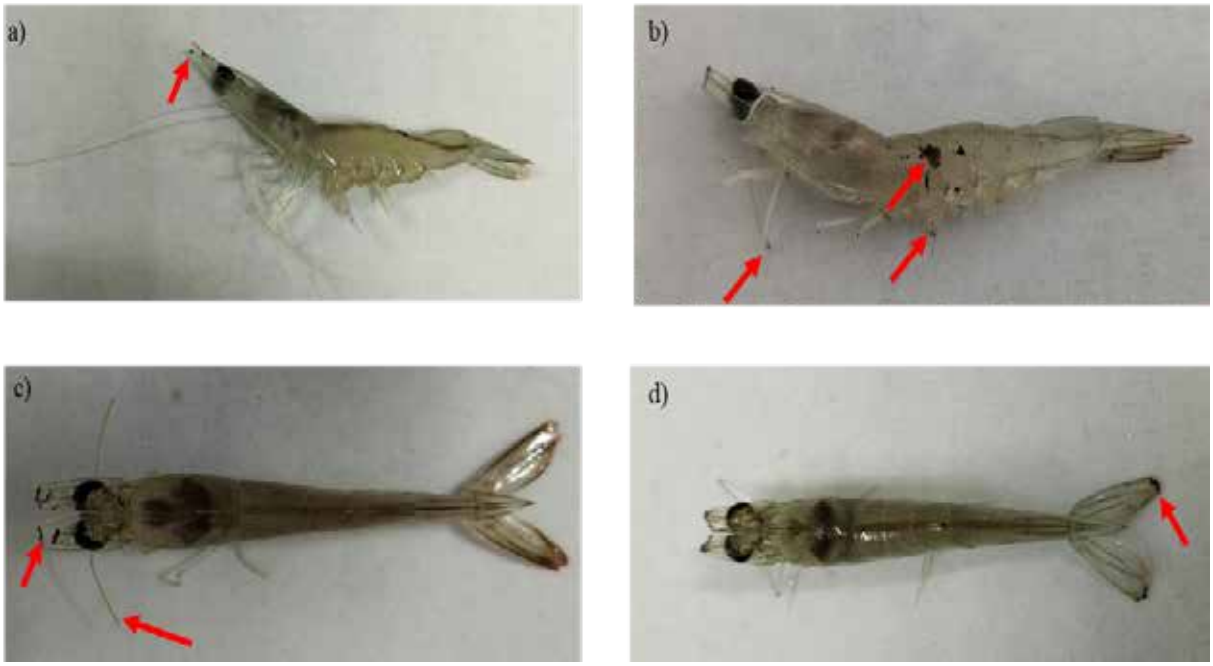
Distribution of M04 metalloprotease in *V. harveyi* isolates

Characterisation of virulence factors and antimicrobial peptide gene expression in haemocytes of the Indian white shrimp challenged with *Vibrio parahaemolyticus*

This study investigated the pathogenicity factors of a *V. parahaemolyticus* isolate from early-larvae of *P. indicus*. The virulence factors associated with biofilm-related genes were identified through PCR amplification. Following immersion challenge with *V. parahaemolyticus* (1×10^6 CFU/ml), the relative expression of antimicrobial peptide (AMP) genes in circulating hemocytes of juvenile shrimp (2.0 ± 0.5 g; n=30 per tank) was examined at 0, 12, 24, 48, 72, and 96 hpi. PCR amplification was positive for *toxR*, *trh*, *aphA*, *motX*, *flig*, *mcp*, and *puvA*, but negative for *tdh*, *tlh*, *luxO*, and *pomA* genes. The biofilm-related gene expression levels of *V. parahaemolyticus* were observed at different temperatures and time points. The relative expression of AMP genes, such as crustin, penaeidin, ALF, and stylicin, showed significant upregulation ($p < 0.05$) at 96 hpi. Notably, this is the first report to highlight the expression of stylicin in the haemocytes of *P. indicus* during infection, underscoring the importance of AMPs in innate immunity against *V. parahaemolyticus*.



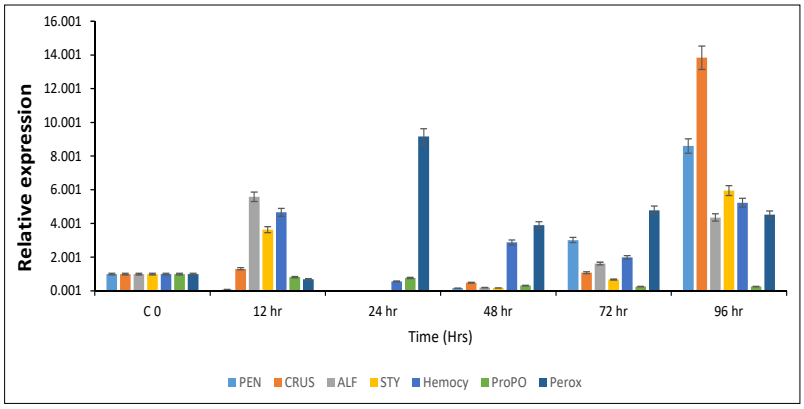
Relative expression of antimicrobial peptide genes in haemocytes of *P. indicus* challenged with *V. parahaemolyticus* (Crustin (a), Penaeidin (b), Anti-lipopolysaccharide factor (c), Stylicin (d) genes) .



The clinical symptoms of shrimp, *P. indicus,* after *V. parahaemolyticus* infection observed necrosis of antennule (a), antennule scale (b), antenna cut (c), uropods, and exoskeleton (d).

Expression of immune-related genes of Indian white shrimp following exposure to pathogenic *Vibrio alginolyticus*

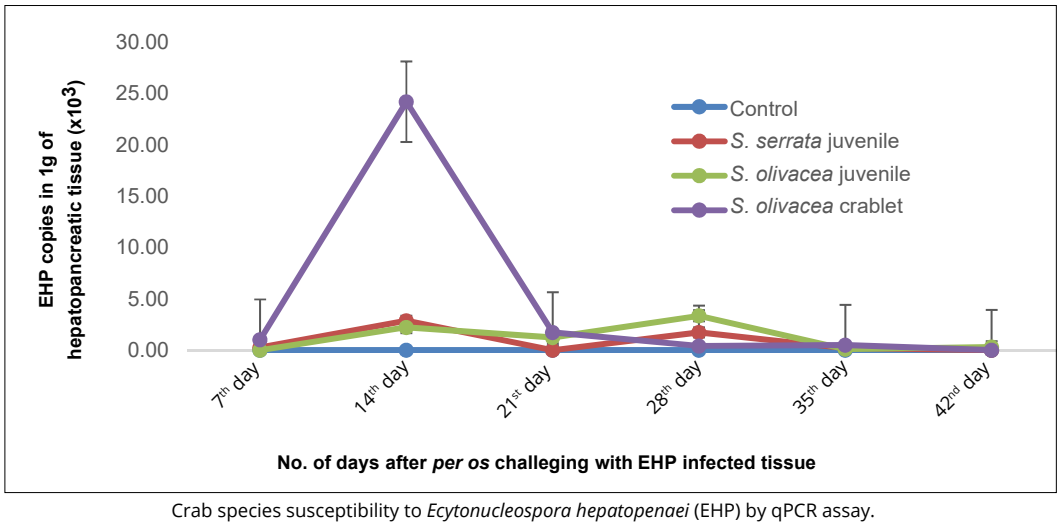
The molecular identification of *V. alginolyticus* and its immune response induction in *P. indicus* was studied by using a natural immersion technique in juvenile shrimp. The expression profiles of key immune genes prophenoloxidase (proPO), peroxinectin, and antimicrobial peptides (AMPs), including crustin, penaeidin, anti-lipopolysaccharide factor, stylicin, and hemocyanin, were analyzed in haemocytes at 0, 12, 24, 48, 72, and 96 hpi. The 16S rRNA sequence (GenBank: PQ821104) showed 98.18% identity with *V. alginolyticus* (MT299676), confirming species identity. Significant temporal variations in the expression of immune genes were observed following infection. AMP genes were notably upregulated, indicating their active role in haemocyte-mediated defense. The modulation of antioxidant and antimicrobial peptide transcripts suggests coordinated innate immune responses against bacterial challenge.



Quantitative real-time PCR expression analysis: The time-course relative expression of prophenoloxidase, peroxinectin, crustin, penaeidin, antilipopolysaccharide factor, stylicin, and hemocyanin transcripts in haemocytes of *P.indicus*, after immersion challenge with *V. alginolyticus*.

Host range susceptibility to EHP infection in shrimp and crab species

Microsporidian parasite, EHP, causing hepatopancreatic microsporidiosis (HPM) in shrimp is an economically significant pathogen. To understand the host variation in susceptibility to this pathogen, a 42-day multiple-dose challenge study was conducted in triplicate using three shrimp species, *P. vannamei, P. monodon*, and *P. indicus,* and two crab species, *Scylla serrata* and *S. olivacea*. Shrimp HP and gut with EHP load of 22.31×10^6 copies g^{-1} was fed to each group for five days. qPCR analysis revealed that there was a significantly higher EHP load in HP of *P. vannamei* (64.35×10^6 copies g^{-1} of HP tissue) followed by *P. monodon* (1.61×10^6) and *P. indicus* (0.02×10^6), indicative of shrimp species susceptibility variation to EHP. Crab hepatopancreas (HP) showed a very low EHP load, with a consistent decline up to 42 days post-challenge (dpc), suggesting the absence of EHP establishment and/or proliferation in the HP tissues of the crab.



Crab species susceptibility to *Ecytonucleospora hepatopenaei* (EHP) by qPCR assay.

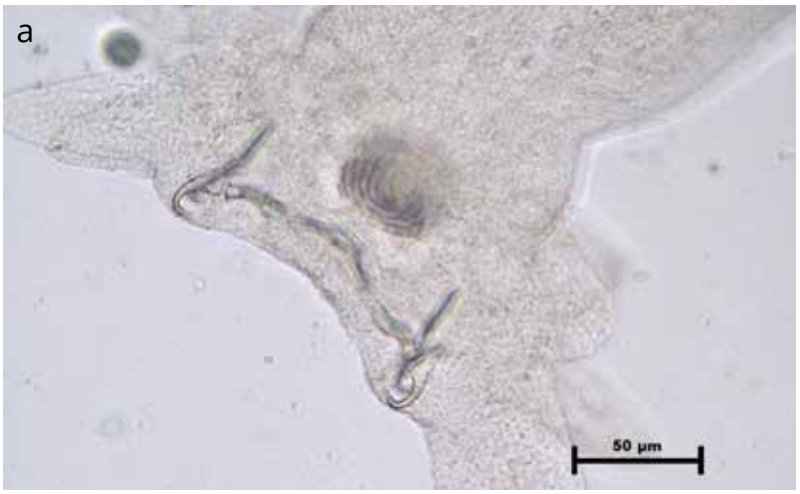
Bacterial pathogens associated with morbidity in farmed mud crabs

Diseased mud crabs (*S. serrata*) were collected from open-water crab pens and estuarine habitats in the Tiruvallur (n = 5), Nagapattinam (n = 3), and Chengalpattu (n = 6) districts of Tamil Nadu, and Thrissur district of Kerala (n = 5), with salinity ranging from 10 to 24 ppt. Clinical signs included darkened carapace, reduced responsiveness to stimuli, and loss of appetite. Haemolymph was used for bacterial isolation, gills were screened for parasites, and pooled tissues were analysed for viral pathogens. All samples were negative for WSSV, EHP, and mud crab reovirus (MCRV), and the gills were free of ectocommensals, including *Octolasmis* spp. Total bacterial counts in haemolymph ranged from 2.3×10^3 to 1.4×10^5 CFU mL^{-1}. Bacterial isolates recovered from the haemolymph *V. alginolyticus*, *Marinobacter nauticus*, and *Aeromonas* spp., along with other opportunistic environmental *Vibrio* species, indicate bacterial involvement in the disease condition.

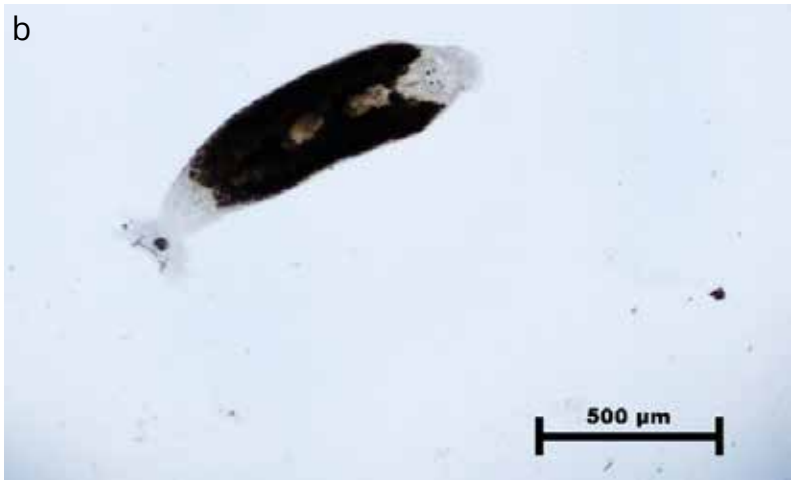
Mudcrab showing darkened carapace

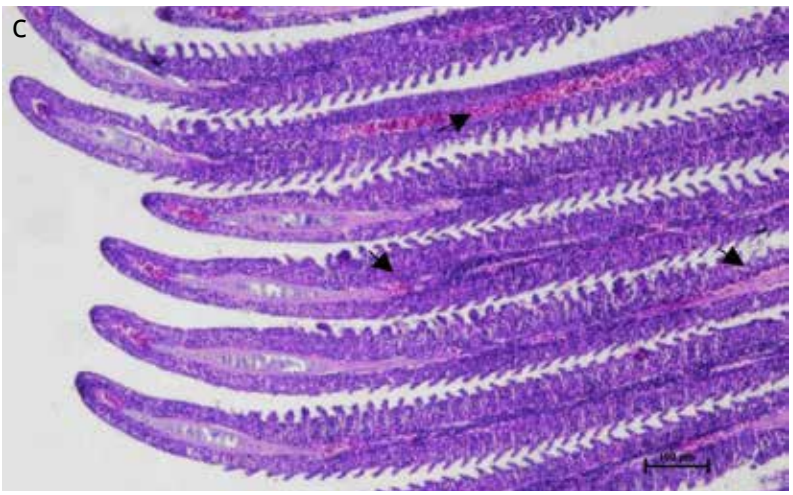
Monogenean gill fluke infests farmed Asian seabass

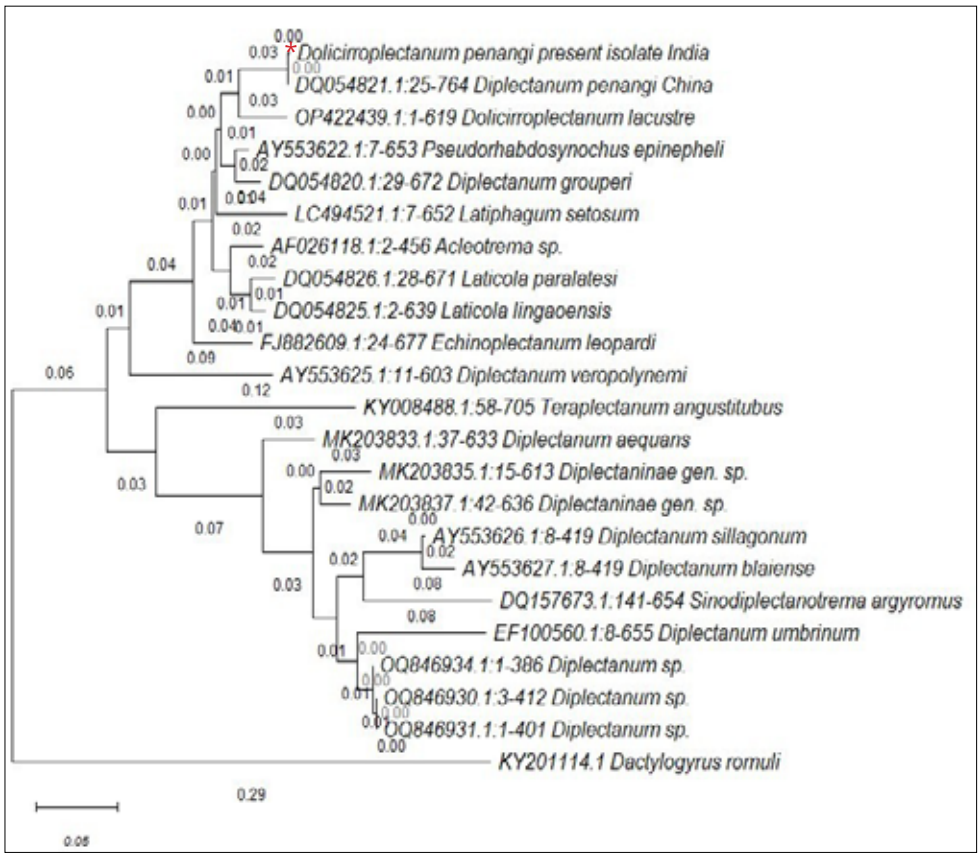
Mortalities of farmed Asian seabass, *Lates calcarifer*, reared in recirculatory aquaculture systems (N=16) and fish tanks (N=500) were attributed to severe infestation with monogenean gill flukes. Affected fish were lethargic and anorectic, exhibiting darkened body



coloration with greyish patches, and mortality occurred at a rate of 2–3 fish per day in fish tanks. Parasitological examination revealed a 100% prevalence of infection, with a mean intensity of 42.91 ± 19.37 monogenean gill flukes per infected fish. Morphological features, including paired squamodiscs and a sclerotised male copulatory organ, confirmed the parasite's placement within the family *Diplectanidae*. Molecular characterisation by 28S rRNA gene followed by BLASTn analysis demonstrated 99.76% sequence identity with *Dolicirroplectanum penangi* and phylogenetic analysis showed close clustering with isolates previously reported from China. Histopathological examination of infected gills revealed engorged blood vessels in the primary lamellae, fusion and hyperplasia of secondary lamellae, marked cellular infiltration, and disruption of lamellar architecture at parasite attachment sites.







Dolicirroplectanum penangi recovered from infested Asian seabass reared in fish tanks and recirculatory aquaculture systems.

(a) Squamodisc on the haptor showing concentric rows of rod-like sclerites;

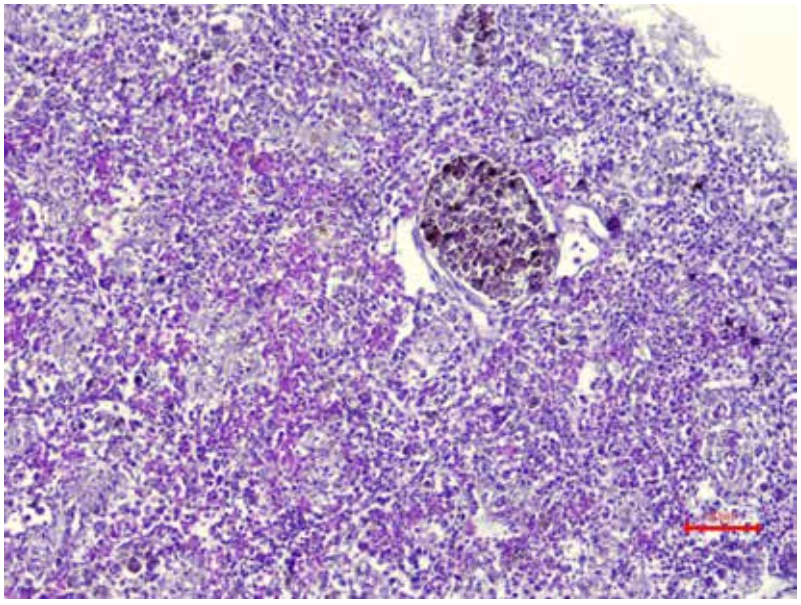
(b) Whole-mounted adult flukes;

(c) Gill illustrating engorged blood vessels, disruption and fusion of secondary gill lamellae, and epithelial hyperplasia;

(d) Phylogenetic tree based on 28S rRNA gene sequences of diplectanids infecting teleost fishes, showing the clustering of the present isolate, *D. penangi*.

Investigation of large-scale mortality of pearlspot broodstock

A large-scale mortality event in *Etroplus suratensis* broodstock was investigated in the absence of evident clinical symptoms. Diagnostic screening confirmed that samples were negative for major viral pathogens, including Viral Nervous Necrosis, Tilapia Lake Virus, and Tilapia Parvovirus. Bacteriological analysis of liver, kidney, and spleen samples led to the isolation of multiple bacterial strains, among which *Ignatzschineria* spp. (Isolate SDKRC-29) was identified as the causative agent. Challenge experiments demonstrated 100% mortality within 72 hours at a dose of 5×10^5 CFU per fish. The isolate was molecularly characterized, and its 16S rRNA gene sequence was submitted to NCBI (Accession No. PQ898052).



Spleen showing melanomacrophage centre (MMC) and necrosis in *E. suratensis.* H&E stain.

Opportunistic saprophytic fungal infection in Yellowfin Seabream

Heavy mortality of yellowfin seabream (*Acanthopagrus datnia*) was recorded during the winter months (December-January 2025), when water temperature ranged from 16.0 ± 0.1 to 22.4 ± 0.49 °C. Infected fish exhibited weakness, haemorrhagic lesions on the skin and fins, along with white to grey cotton-like growth. The causative pathogen was isolated and identified as *Pseudallescheria paradoxa*. Histopathological examination revealed extensive fungal hyphae in the epidermis and necrotic lesions in the muscle tissues. The findings indicate that *P. paradoxa* is a potential pathogen in *A. datnia*. This study provides baseline information on the pathology and environmental conditions associated with fungal infections in brackishwater fish species, contributing to improved disease understanding and management.

a) External signs of *P. paradoxa* infection.

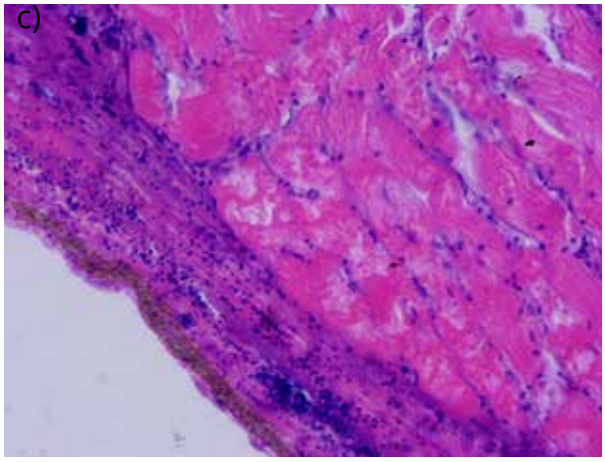
b) Hyphae attached on fish scale with many sporangia.

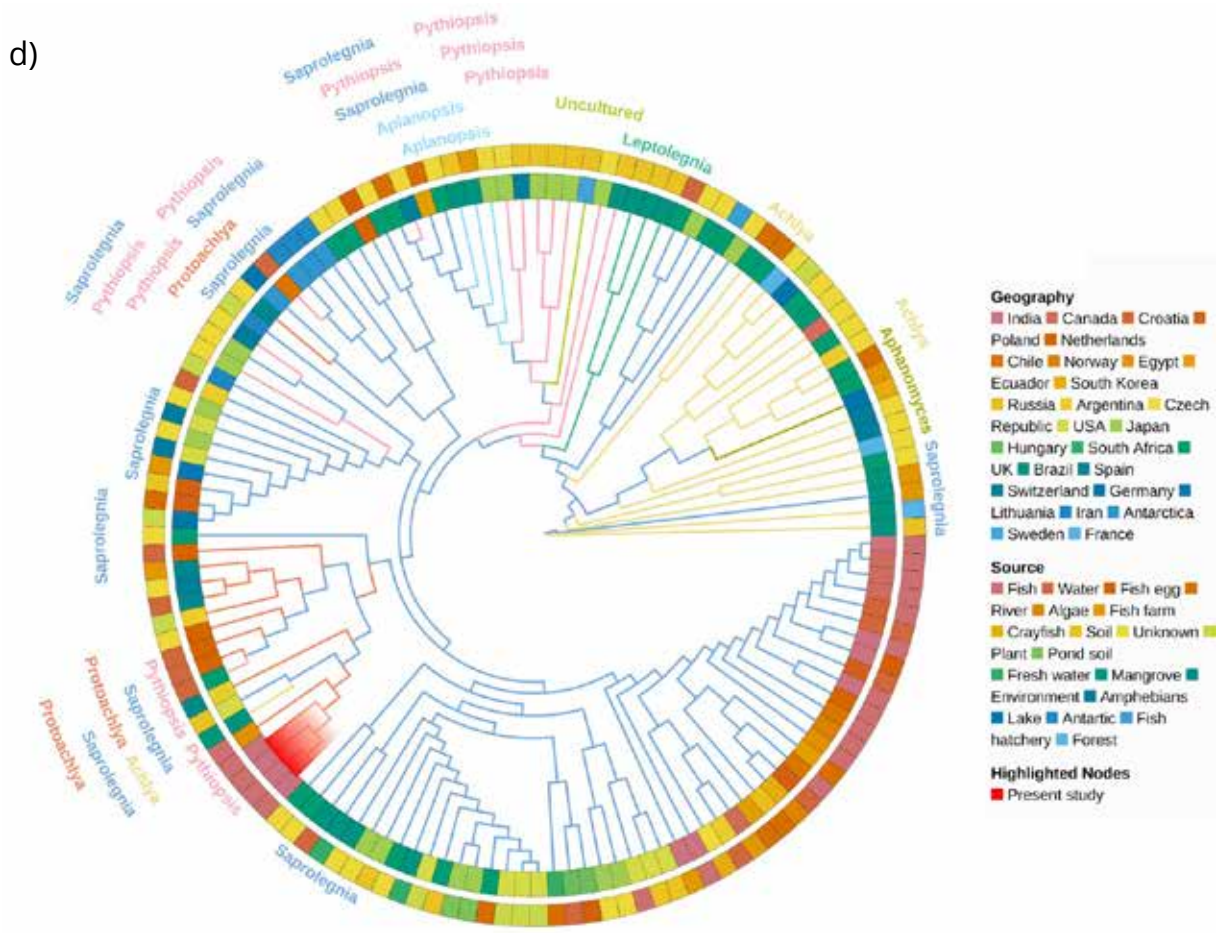
c) Histopathology of *P. paradoxa* infected skin and muscle.

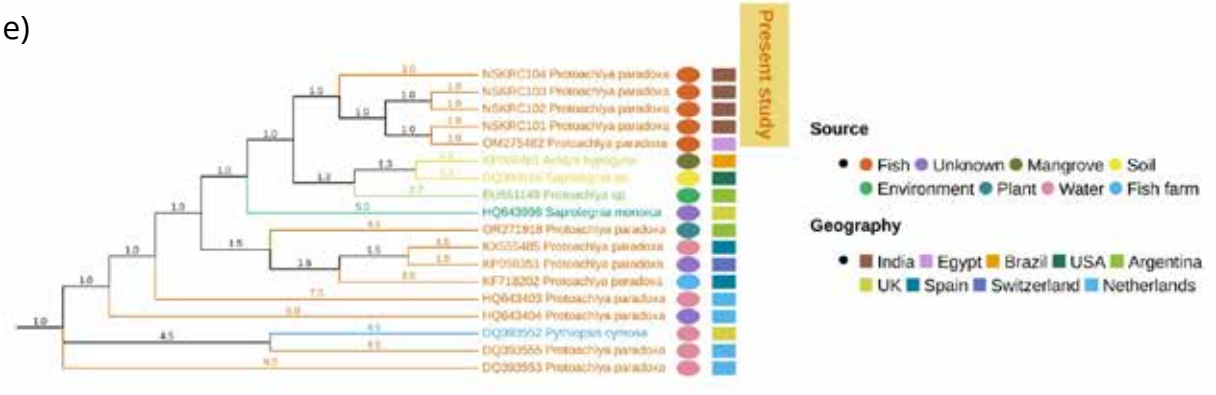
d) Global position of *P. paradoxa* among *Saprolegniaceae*.

e) Phylogenetic tree of the present isolate.

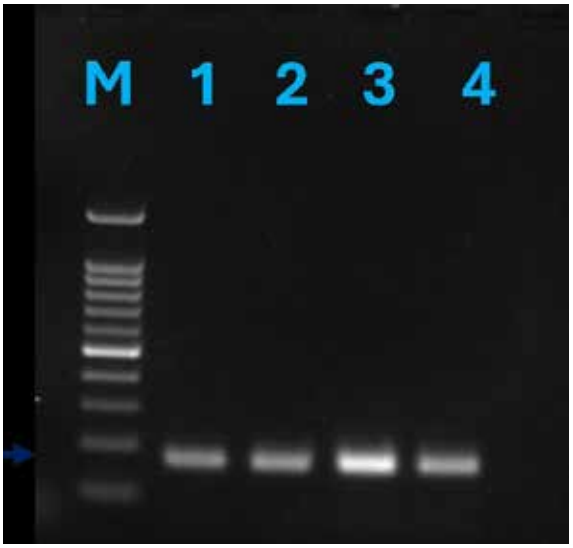

b)


c)


d)
Saprolegnia
Pythiopsis
Aplanopsis
Uncultured
Leptolegnia
Achlya
Aphanomyces
Protoachlya
Geography
India Canada Croatia Poland Netherlands Chile Norway Egypt Ecuador South Korea Russia Argentina Czech Republic USA Japan Hungary South Africa UK Brazil Spain Switzerland Germany Lithuania Iran Antarctica Sweden France
Source
Fish Water Fish egg River Algae Fish farm Crayfish Soil Unknown Plant Pond soil Fresh water Mangrove Environment Amphebians Lake Antartic Fish hatchery Forest
Highlighted Nodes
Present study


e)
Present study
Source
Fish Unknown Mangrove Soil
Environment Plant Water Fish farm
Geography
India Egypt Brazil USA Argentina
UK Spain Switzerland Netherlands

Application of CRISPR/ Cas systems for sensitive detection of shrimp viral and microsporidian pathogens



M – 100bp Marker
Lane 1-4 : Sample tested positive for EHP

Detection of EHP by RPA assay

A rapid, instrument-free nucleic acid extraction method was developed for the detection of WSSV and EHP in farmed shrimp. The DNA extraction process was completed within two minutes and subsequently utilized as a template for one-pot RPA-CRISPR/Cas12a detection. Using this approach, WSSV was visually detected within 30 minutes in 28% of the analysed samples (N = 84), demonstrating its suitability for point-of-need diagnosis without the requirement for sophisticated laboratory equipment. In addition, a Recombinase Polymerase Amplification (RPA)-based assay was developed for EHP detection using custom-designed primers targeting the polar tube protein 2 (PTP2) gene, generating the expected 139 bp amplicon. The RPA assay enabled rapid detection of EHP within 20 minutes, with 54% positivity among the tested samples. Specificity analysis using WSSV and IHHNV confirmed the absence of cross-reactivity, indicating high assay specificity.

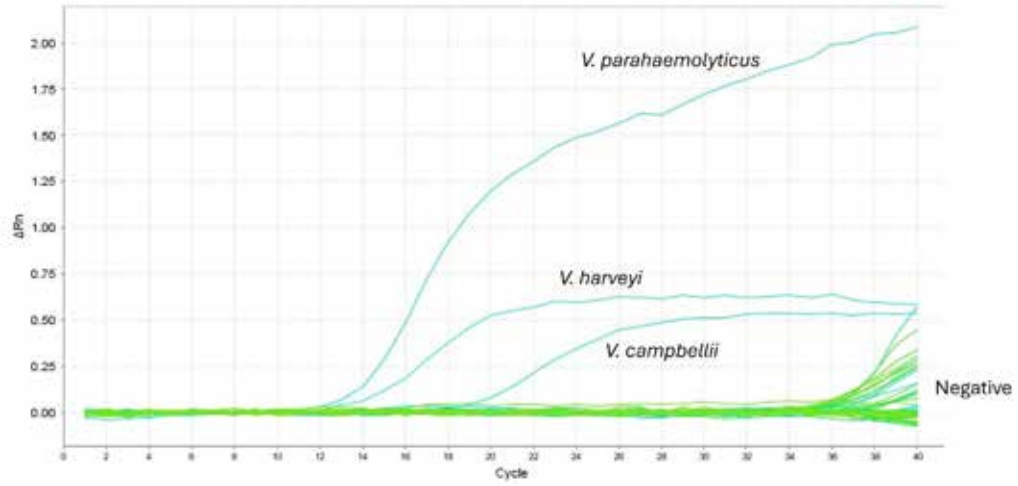
Multiplex LAMP coupled lateral flow for the simultaneous detection of WSSV and EHP

White spot syndrome virus and EHP are the two major pathogens causing severe economic losses in shrimp aquaculture. A multiplex LAMP-coupled lateral flow assay was developed for their simultaneous detection. The LAMP primers targeting the VP28 gene of WSSV and the spore wall protein (SWP) gene of EHP were used. This multiplex LAMP was performed in a simple dry bath and optimised at 65°C. This assay demonstrated high sensitivity, detecting as few as 10 copies of each pathogen. This assay was rapid and can detect within 55 minutes, including LAMP amplification and lateral flow readout time. This assay demonstrated 100% diagnostic sensitivity and specificity. This multiplex LAMP assay, coupled with lateral flow, provides a rapid, reliable, sensitive, and specific point-of-care diagnostic tool suitable for routine on-farm surveillance.

mLAMP-LFA detection kit with lateral flow strip

Triplex quantitative real time PCR developed for *Vibrio* spp.

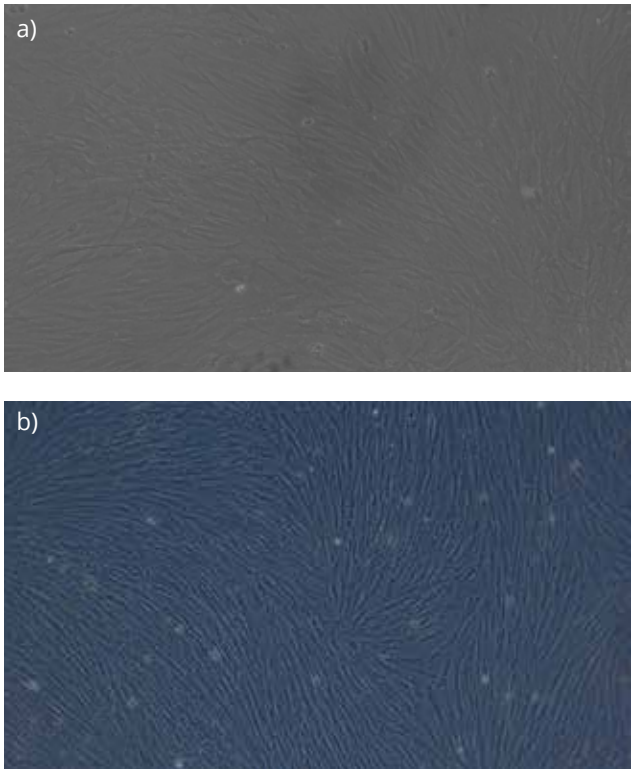
A quantitative real-time PCR (qPCR) assay was developed for the rapid detection and quantification of three important marine pathogens: *V. parahaemolyticus, V. harveyi,* and *V. campbellii*. Species-specific primers were designed targeting novel marker genes identified through differential pangenome analysis. The assay was optimized to achieve high amplification efficiency and reliable detection. Specificity was evaluated against a panel of 18 bacterial pathogens commonly associated with aquatic environments, including several closely related vibrios. The assay exclusively amplified the target *Vibrio* species without any cross-reactivity, confirming high specificity and 100% sensitivity. The developed qPCR assay provides a rapid, sensitive, and highly specific diagnostic tool for the detection and differentiation of these pathogenic *Vibrio* species associated with aquatic diseases. The assay can be used as a valuable tool for disease surveillance, early pathogen detection, and improved management of vibriosis in aquaculture systems.



Specificity testing of developed multiplex real time PCR for *Vibrio parahaemolyticus, V. harveyi* and *V. campbellii*

Development and characterization of Asian seabass muscle cell line

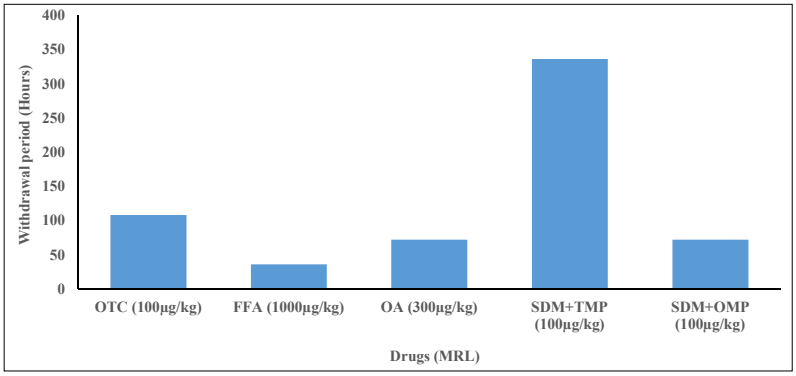
The primary culture of the Asian seabass muscle cell line was continuously passaged 175 times to obtain a continuous cell line. PCR and sequencing of the CO1 gene and 18s rRNA from the cell line confirmed the origin of the cell line as Asian Sea bass, *L. calcarifer*. PCR for MyoD and Pax7 genes amplified products of 977 and 528 bp respectively. Pax7 gene was amplified at 25th passage but not at subsequent passage levels while MyoD was amplified at 25, 50, 103, and 163 passage levels. Eight batches of myoblast differentiation have been done. Upon induction with differential medium myoblast differentiated into myotubules and myofibrils. The cell growth and doubling time of the cell line were estimated. The log phase lasted till 4 days after seeding, and the cell concentration decreased thereafter. The cell doubling time of the population was estimated as 21 h 19 min. The growth rate was calculated as 0.0325/hr.



Asian seabass muscle cell line at passage level 81 (a) and 173 (b)

Withdrawal period of selected therapeutants in Asian seabass

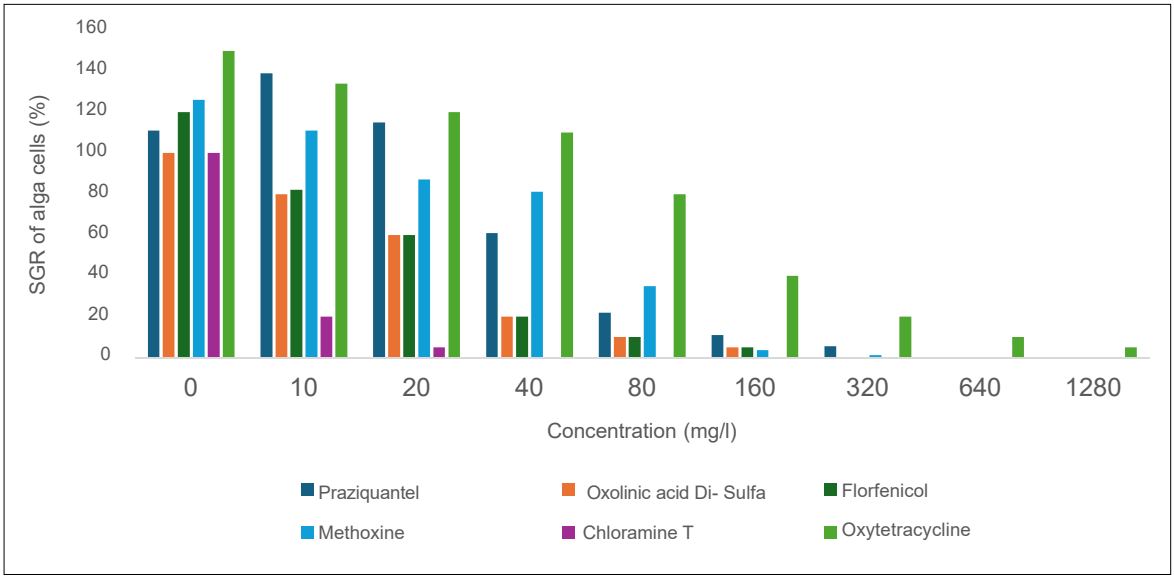
A residue depletion study was conducted in Asian seabass (20 ± 2 g) to determine the withdrawal periods of selected therapeutants: oxytetracycline (OTC) at 80 mg/kg biomass for 10 days; florfenicol (FFA) at 15 mg/kg biomass for 10 days; oxolinic acid at 12 mg/kg biomass for 7 days; sulfadimethoxine + trimethoprim (SDM+TMP, 5:1) at 50 mg/kg for 5 days; and sulfadimethoxine + ormetoprim (SDM+OMP, 5:1) at 50 mg/kg for 10 days. Residue concentrations were monitored post-treatment and compared with established maximum residue limits (MRLs). The estimated withdrawal periods were 4.5 days for OTC, 1.5 days for FFA, 3 days for SDM+OMP, and 14 days for SDM+TMP. These results demonstrate substantial variation in the withdrawal periods of antimicrobial agents used in marine finfish farming, highlighting the need for careful consideration to ensure food safety and regulatory compliance.



Withdrawal period of therapeutants in Asian seabass

Environmental toxicity assessment of selected veterinary medicinal products

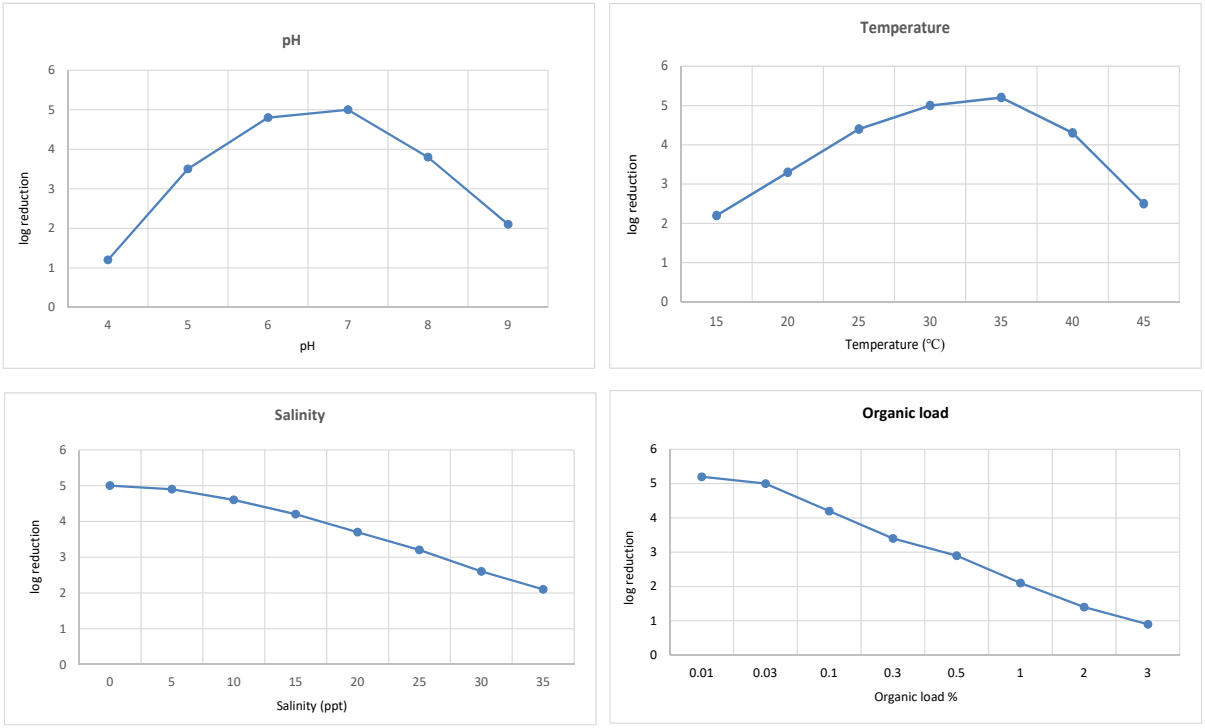
The environmental toxicity of selected antiparasitic and antibiotic compounds was evaluated using aquatic indicator organisms, including the green microalga *Chlorella marina*, the diatom *Thalassiosira* spp., and representative crustaceans (copepods and rotifers). Among the antiparasitic agents, praziquantel, lufenuron, and emamectin benzoate were found to be safe at concentrations up to 80 mg/L, 75 mg/L, and 100 µg/L, respectively, across the indicator organisms. Among the antibiotics, oxolinic acid was safe for *C. marina* (up to 40 mg/L), *Thalassiosira* spp. (up to 80 mg/L), copepods (up to 40 mg/L), and rotifers (up to 75 mg/L). Similarly, florfenicol demonstrated safety at 16–20 mg/L in algae and 8–16 mg/L in crustaceans, while oxytetracycline was safe up to 320 mg/L in copepods and rotifers. In contrast, di-sulfamethoxine exhibited no toxicity to crustaceans up to 40 mg/L. Overall, the findings indicate that the tested veterinary medicinal products (VMPs) are safe at therapeutic exposure levels.



Growth inhibition of algae exposed to different drugs

Efficacy of chloramine T as an aquaculture disinfectant

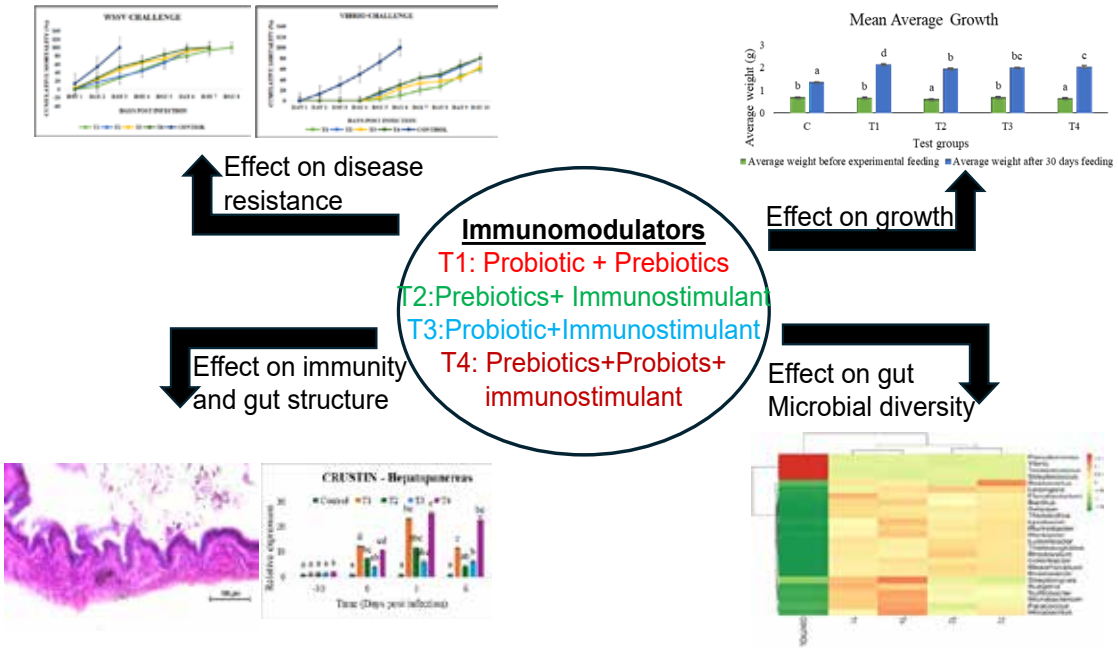
The *in vitro* efficacy of chloramine T against *Vibrio* spp. and *Aeromonas* spp., evaluated using broth dilution and MIC assays, showed effectiveness at 1–2 ppm, while it was 5 ppm in the presence of organic load. The duration of activity of chloramine T was assessed in freshwater and was found to be bactericidal for up to 2–3 hours, with residual activity observed up to 24 hours. Free chlorine activity persisted for up to 4 hours. Moderate activity was observed at 0.2% for up to 2 hours, while lower activity persisted for 1–2 hours at 1% and for more than 1 hour at 3%. Environmental factors such as pH, temperature, salinity, and organic load influenced the performance of the disinfectant. Among these, organic load was the most critical factor, with full bactericidal efficiency at 0.02% and complete neutralization at 3% organic load.



Effect of pH, temperature, salinity and organic load on efficacy of Chloramine T

Immunomodulator combinations for improved growth, health performance, and immune competence in Pacific white shrimp

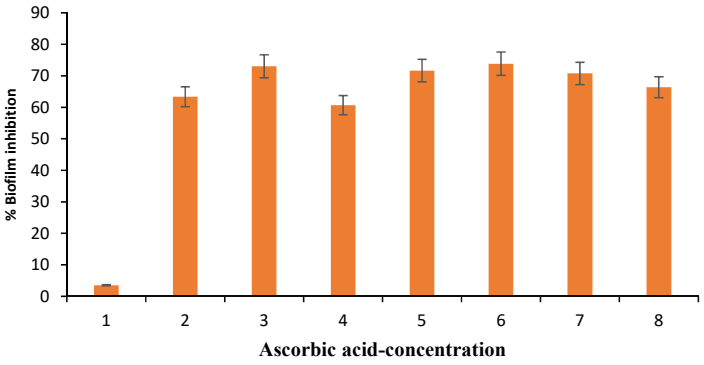
Immunomodulators provide greater hope for effective disease management and aquaculture sustainability. In this regard, three of the most commonly used immunomodulators in aquaculture, such as probiotic (*Bacillus subtilis* – 10^7 CFU/ml), prebiotic (inulin – 10 g/kg), and immunostimulant (β-glucan – 4 g/kg), were used in four different combinations (T1: prebiotic & probiotic, T2: prebiotic & immunostimulant, T3: probiotic & immunostimulant, and T4: prebiotic, probiotic and immunostimulant) to observe their synergistic effects on growth, disease resistance, gut structure, gut microbial diversity, and immunity. A 30-day oral feeding trial in Pacific white shrimp (*P. vannamei*) with immunomodulator-coated feed performed better in all combinations tested compared to the control. However, the prebiotic and probiotic combination was superior among all the combinations with respect to all aspects. The use of these immunomodulators did not affect water quality throughout the experimental period. Therefore, the combination involving both probiotics and prebiotics proved to be the most suitable for shrimp aquaculture.



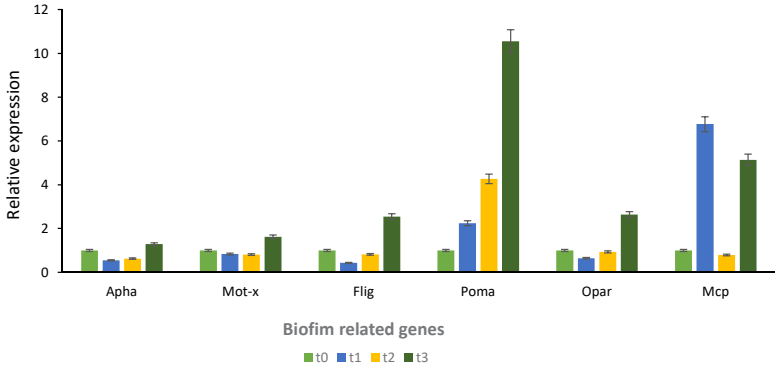
Impact of dietary immunomodulators on growth, immunity, gut health and disease resistance in shrimp

Antibacterial and antibiofilm potential of ascorbic acid against shrimp-pathogenic *Vibrio parahaemolyticus*

The anti-*Vibrio* efficacy of ascorbic acid against *V. parahaemolyticus* isolated from moribund *P. indicus* larvae was evaluated. The pathogen was characterized through biochemical assays and molecular detection of virulence-associated genes. Growth kinetics of biofilm formation were assessed at 27 °C and 32 °C over 24 h, along with the antibacterial and antibiofilm activity of different concentrations of ascorbic acid. The isolate showed enhanced growth and biofilm production at 32°C. PCR analysis confirmed the presence of *toxR, tlh, AphA,* and *MotX* genes, whereas *trh* and *tdh* genes were absent. Treatment with ascorbic acid inhibited more than 50% of biofilm formation within 24 h and significantly downregulated biofilm-associated gene expression. The findings indicate that ascorbic acid can effectively reduce the virulence and biofilm-forming ability of *V. parahaemolyticus*, suggesting its potential as a sustainable non-antibiotic strategy for the management of *Vibrio* infections and the improvement of shrimp health in aquaculture systems.



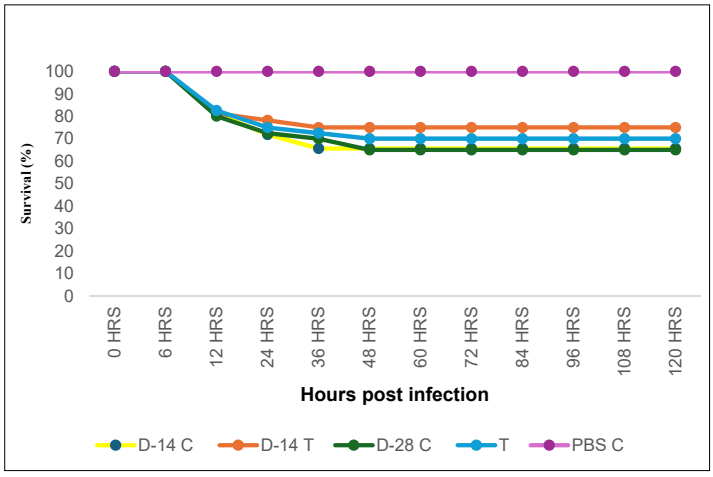
The percentage of *Vibrio*-biofilm inhibition of ascorbic acid at different concentrations



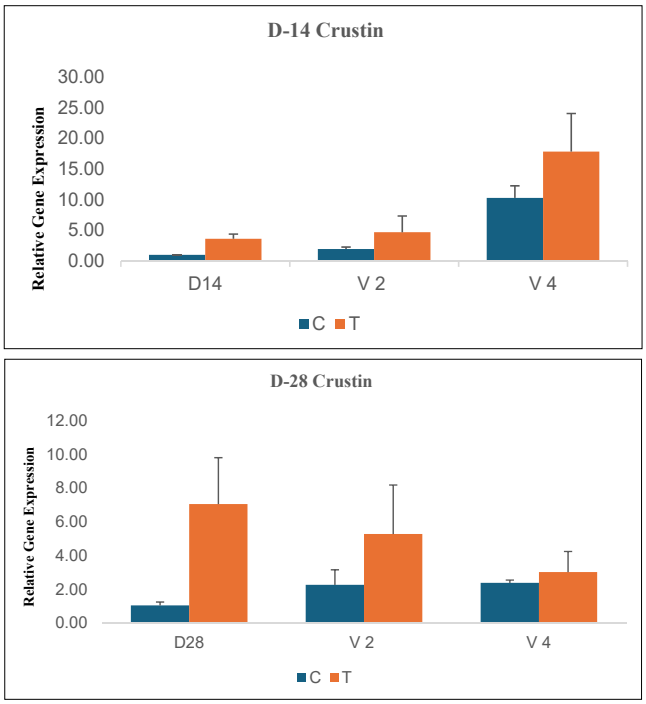
The relative expression level of biofilm-related genes of *V. parahaemolyticus* against ascorbic acid treatment. (t0-control group; t1, t2, t3- treatment group).

Enhanced immune regulation and anti-*Vibrio* response in Pacific white shrimp fed with brown seaweed

This study evaluated the immunomodulatory effects of the brown seaweed *Ascophyllum nodosum* in *P. vannamei* following challenge with *V. parahaemolyticus*. Shrimp (average body weight: 3.0 ± 0.25 g) were fed a diet top-coated with *A. nodosum* at 37 mg kg $^{-1}$ of feed, for 28 days. Animals were challenged with *V. parahaemolyticus* (8.0 × 10^5 CFU mL^{-1}) via intramuscular injection on 14th and 28th day. *A. nodosum* fed shrimps showed 32.68% increase in ABW at day 14 and survival rates (10% and 5% on 14th and 28th day respectively) upon challenge with *V. parahaemolyticus*. Catalase (21.2 IU/mg of protein) and superoxide dismutase (SOD) (723.7 IU/mg of protein) were significantly higher than the control group with Catalase (14.2 IU/mg of protein) and superoxide dismutase (SOD) (426 IU/mg of protein). Immune genes, crustins, HSP70, and P53, exhibited peak upregulation at all time points, however, penaeidin and lysozyme significantly up regulated on 28th day under challenge. The current study revealed the strong immunomodulatory effects of the brown seaweed supplementation in *P. vannamei.*



The survival rate of Brown seaweed fed and control fed *P. vannamei* challenged with *V. parahaemolyticus.*



Relative gene expression levels of crustin after challenge with *V. parahaemolyticus,* a) Relative gene expression of crustin after 14 days (D 14) of feeding (V 2- 2 days after *Vibrio* challenge: V 4-4 days after *Vibrio* challenge). b) Relative gene expression of crustin gene after 28 days of feeding (V2- 2 days after *Vibrio* challenge: V4- 4 days after *Vibrio* challenge) compared to control

Field validation, performance, and stability of CIBA EHP Cura Gro+ in shrimp farming

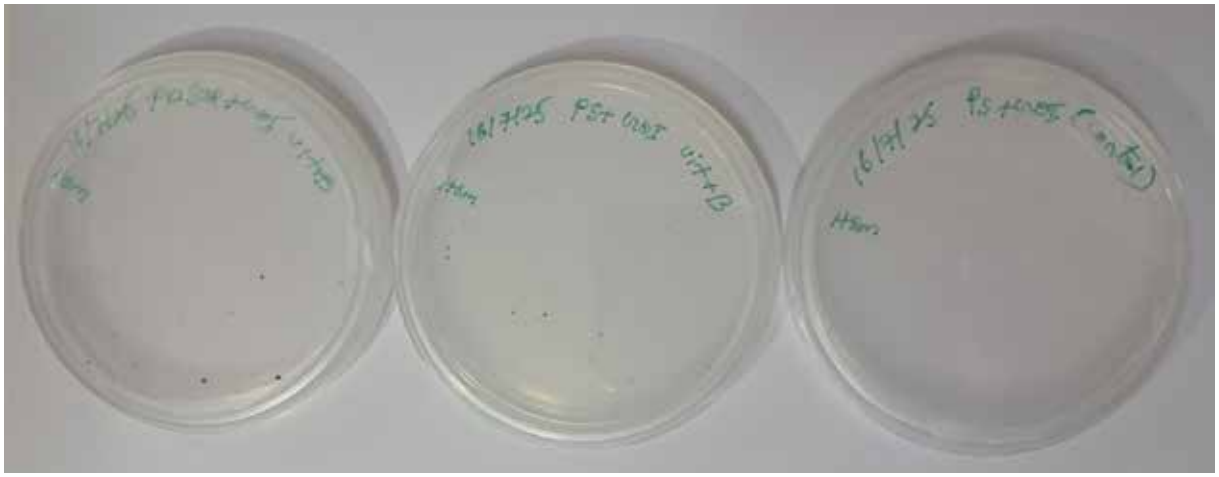
CIBA EHP Cura Gro**+** was field evaluated in 104 farms across Tamil Nadu, Andhra Pradesh, Punjab, West Bengal, and Gujarat. Approximately 9200 L of the product were utilized during the field evaluation. During evaluation, the product significantly reduced EHP and *Vibrio* loads in all the farms tested and was found to control white feces syndrome in 75% of the farms. The survival rate improved from 67 ± 15.2% to 80 ± 11.8%, and the feed conversion ratio (FCR) improved from 1.71 ± 0.29 to 1.37 ± 0.21. Preliminary economic analysis showed that the average production in EHP-affected ponds was 3996 ± 1862 kg per hectare, whereas CIBA EHP Cura Gro +–treated ponds achieved 6478.8 ± 2488 kg, representing a 62% increase in production. Furthermore, stability evaluation showed that nitrogen, vacuum, and conventional packaging retained the active components for up to one year, demonstrating good product stability.

Nationwide outreach and sensitization programme for dissemination of CIBA EHP Cura Gro+

A series of outreach and technology demonstration programmes were conducted in collaboration with NFDB to popularise the use of CIBA EHP cura Gro+ across major shrimp clusters in India. The programmes were organised at Nagapattinam (Tamil Nadu), Churu (Rajasthan), Amalapuram and Bapatla (Andhra Pradesh). The events aimed to create awareness among farmers about EHP and White Feces Syndrome (WFS) and to promote the validated phytobiotic solution CIBA EHP cura Gro+ for effective disease management. More than 600 farmers and aqua professionals participated. Extension booklets in regional languages such as Tamil, Telugu, and Hindi were released and distributed. Quantities of Cura Gro+ were supplied to selected farmers to facilitate large-field adoption.

Expression of nervous necrosis virus capsid protein in microalgae

Viral nervous necrosis (VNN) disease caused by nervous necrosis virus (NNV) is a lethal disease of several fish species resulting in up to 100% mortality in the early life stages. The only practical way to prevent the spread of VNN is to vaccinate during the early life stages by oral and immersion routes. The capsid protein gene of NNV was codon optimized and cloned into expression vectors pSRSapI and pASapI. The recombinant plasmids containing the insert were transformed into *Chlamydomonas reinhardtii* strains TN72 and HT72 by electroporation. After homologous recombination with the plasmid insert, the transformants regained photosynthetic activity and grew in acetate free medium under high-intensity light. The presence of the insert in the recombinant colonies was verified by PCR and sequencing, further confirmed with a western blot. The recombinant clones can be used to vaccinate finfish larval stages by oral and immersion routes against VNN.

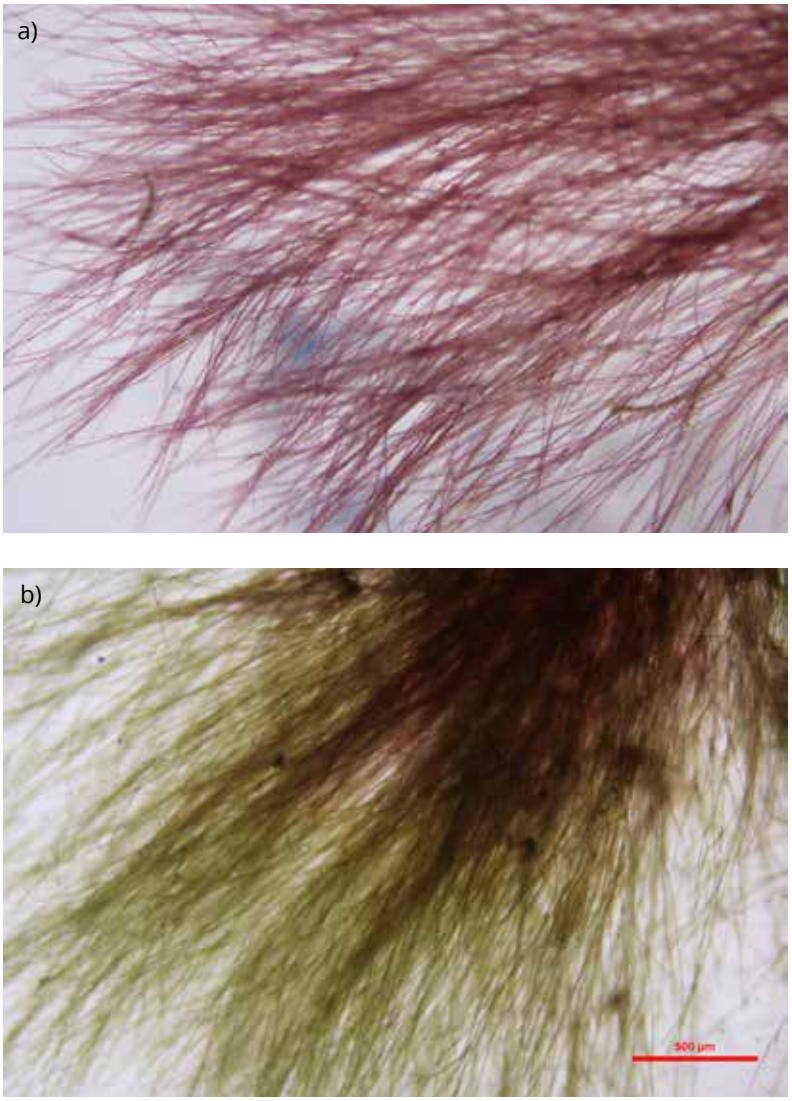


HSM agar plates showing transformed colonies of *C. reinhardtii*

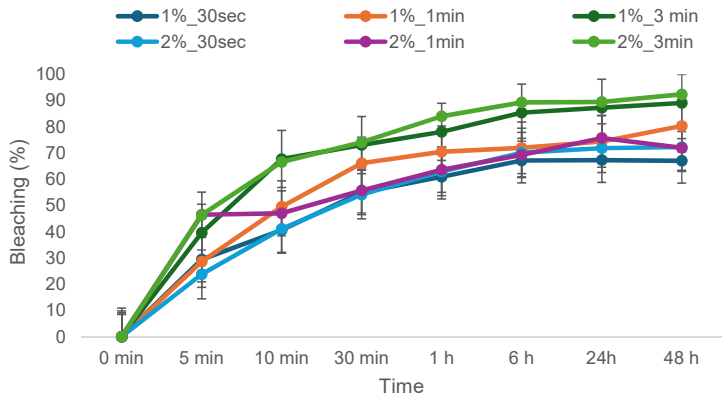
Infestation of seaweed by a red epiphyte and its treatment

An *in vitro* stock of *Gracilaria corticata* was found to be contaminated with a filamentous red alga, morphologically identified as *Colaconema* sp. The contaminant was isolated and scaled up to pure culture in 4 L flasks for experimental evaluation. To identify an effective mitigation strategy, povidone-iodine treatments were tested at four concentrations (0.05%, 0.5%, 1%, and 2%) with three exposure durations (30 s, 1 min, and 3 min). Treatment efficacy was assessed based on discolouration of the contaminant from red to green, indicating bleaching activity. Among the tested treatments, 1% povidone-iodine

for 3 min and 2% povidone-iodine for 3 min were the most effective, achieving more than 90% bleaching within 48 h of observation. However, a reduction in bleaching intensity after seven days indicated regrowth of *Colaconema* sp.



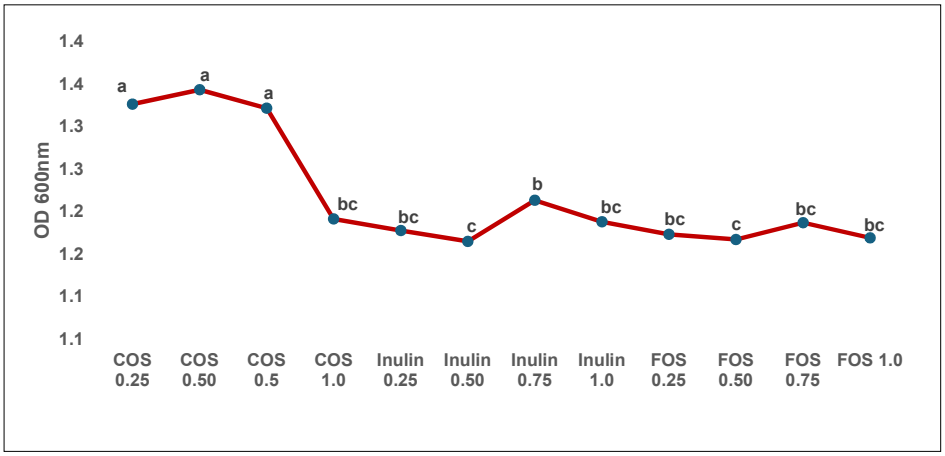
Pre- and post-iodine treatment (a,b) of *Colaconema*



Effect of povidone-iodine treatment on *Colaconema* bleaching

Synbiotic combination profiling with probiotic bacterium

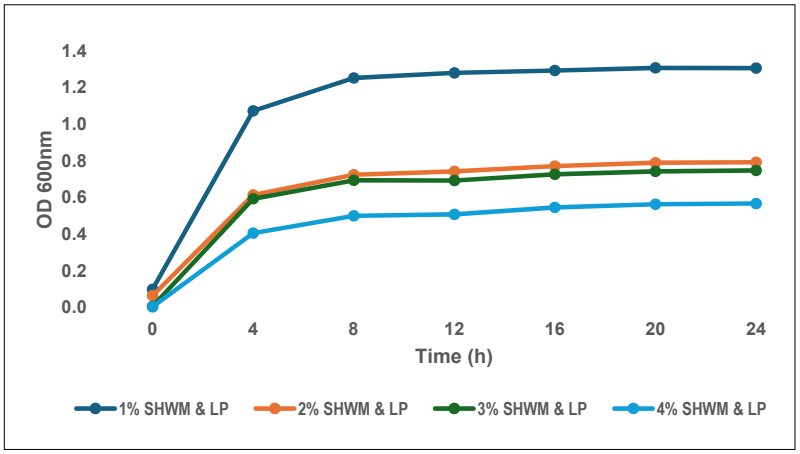
Based on previous findings that 3% dietary supplementation of *Lactobacillus plantarum* functions as an effective feed additive in *P. vannamei*, the present study was undertaken to develop a suitable synbiotic formulation for large-scale application in shrimp farming. Three prebiotics, namely chitosan oligosaccharide (COS), fructooligosaccharide (FOS), and inulin, were evaluated at four concentrations (0.25%, 0.50%, 0.75%, and 1.0%) for their ability to enhance the growth of *L. plantarum*. Among the tested combinations, COS combined with *L. plantarum* at concentrations of 0.25%, 0.50%, and 0.75% showed a significant increase ($p < 0.001$) in OD values at 24 h, indicating enhanced probiotic growth. Fermentation was achieved within 12 h in the presence of prebiotics. The findings suggest that COS at 0.25% in combination with *L. plantarum* may serve as a promising synbiotic functional feed additive for further evaluation in *P. vannamei*.



In vitro screening of the synbiotic combination with *L. plantarum*

Exploration of the shrimp head waste material as prebiotic

The chitin content of processed shrimp head waste material (SHWM) was found to be 11.10±1.48 %. The SHWM was used as the prebiotic @ of 1, 2, 3 and 4% with probiotic *L. plantarum* to study its synbiotic effect. SHWM supplemented @ 1% with *L. plantarum* showed significant growth increase in the OD, 600 nm. The synbiotic combination of 1% SHWM and *L. plantarum* is to be further evaluated as functional feed additive in *P. vannamei.*



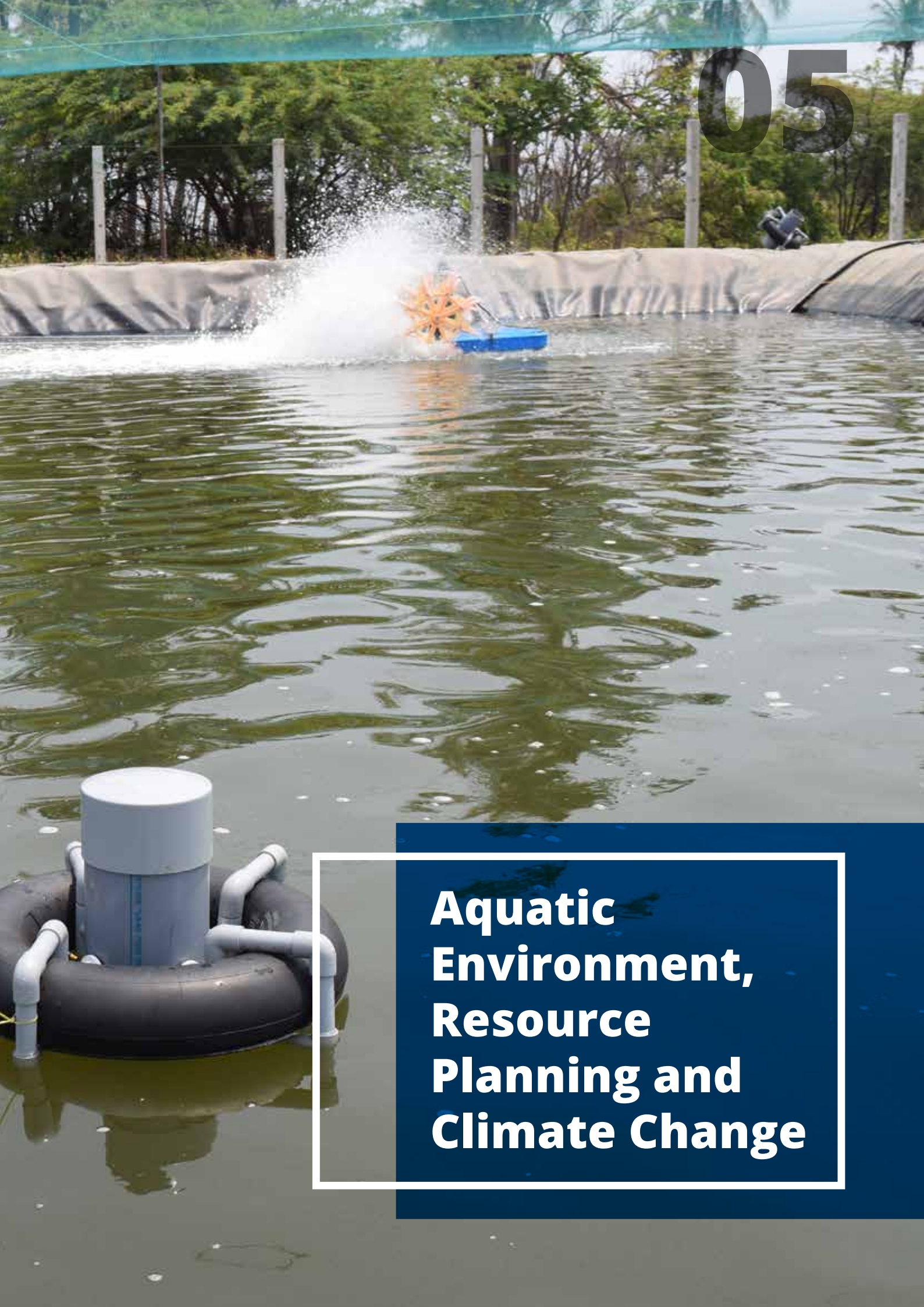
Effect of shrimp head waste material as prebiotic with *L. plantarum*

Design and implementation of IoT with block chain-based traceability system for shrimp supply chain management

It is inevitable to safeguard food safety, food security, product quality, and sustainable farming practices in aquaculture on par with increasing global demand. Traditional supply chain management systems used in shrimp production lack integrated, real-time data recording methods, making it difficult to track shrimp batches from origin to consumption. In order to address these issues, a robust, transparent, and technologically sophisticated traceability architecture integrating IoT sensors, blockchain ledger and Quick Response codes, was developed to monitor and record critical data points throughout the production and distribution process. This system was useful in disease outbreak notifications and control, guaranteed regulatory compliance, boosting operational efficiency, improving supply chain transparency, precise food safety records, and building consumer confidence in the safety of farmed shrimp towards sustainability. This trend encourages the global movement toward safer, traceable, and ecologically aware aquaculture operations by providing farmers, exporters and consumers with verifiable product history. Design and implementation of IoT with block chain-based traceability system for shrimp supply chain management, is a prototype developed and field tested for shrimp end to end value chain with feedback mechanism. This QR code-based system is open platform and amenable for customization to any fish and fishery products, and applied for patent (Patent 202541070414) and included in the National framework on traceability in fisheries and aquaculture., 2025. Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India (Ref. No. j-01013/68/2025-Fy. Dated: 13.10.2025, MoFAHD, DoF, GoI).


NOTICE

05

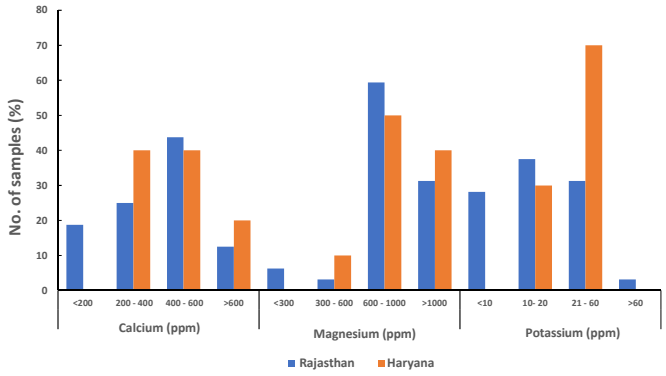


Aquatic Environment, Resource Planning and Climate Change

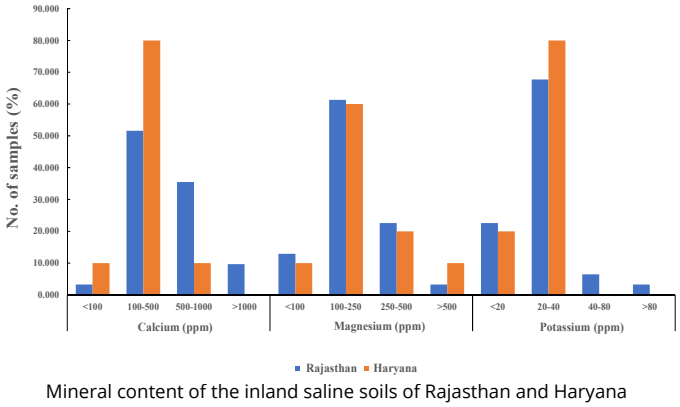
Aquatic Environment, Resource Planning and Climate Change

Soil and water characteristics of Haryana and Rajasthan for inland saline aquaculture

Inland saline aquaculture can effectively utilize salt-affected wastelands when ionic imbalances are corrected through mineral amendments. Studies from Haryana (Charkhi Dadri, Jhajjar, Bhiwani, and Gurgaon) and Rajasthan (Churu and Bikaner) revealed that 50% of water samples had salinity of 11-15 ppt and 45% of water samples had total alkalinity of 251-350 ppm as $CaCO_5$. Notably, high alkalinity (>300 ppm) was more common in Rajasthan (34%) than in Haryana (10%). Over 60% of samples showed a Mg/Ca ratio of 1.7-3.4, more than 75% exhibited a Ca/K ratio of 10-50, and pH within acceptable limits. Soil organic carbon was lower in Rajasthan (84% of soil samples had <0.1% OC), while 80% of Haryana samples had >0.2% OC. Mineral deficiencies were observed in both states. Proper mineral supplementation and alkalinity correction can make these inland saline areas suitable for sustainable shrimp culture.



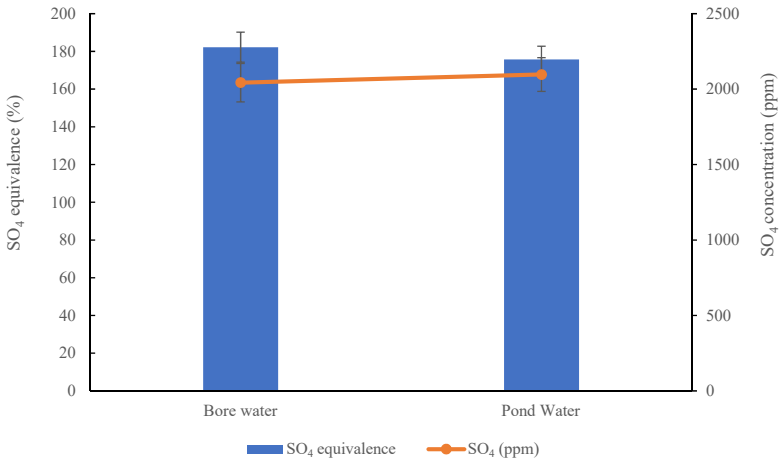
Mineral content of the inland saline waters of Rajasthan and Haryana



Mineral content of the inland saline soils of Rajasthan and Haryana

Persistence of groundwater sulphate concentration in inland saline shrimp culture ponds

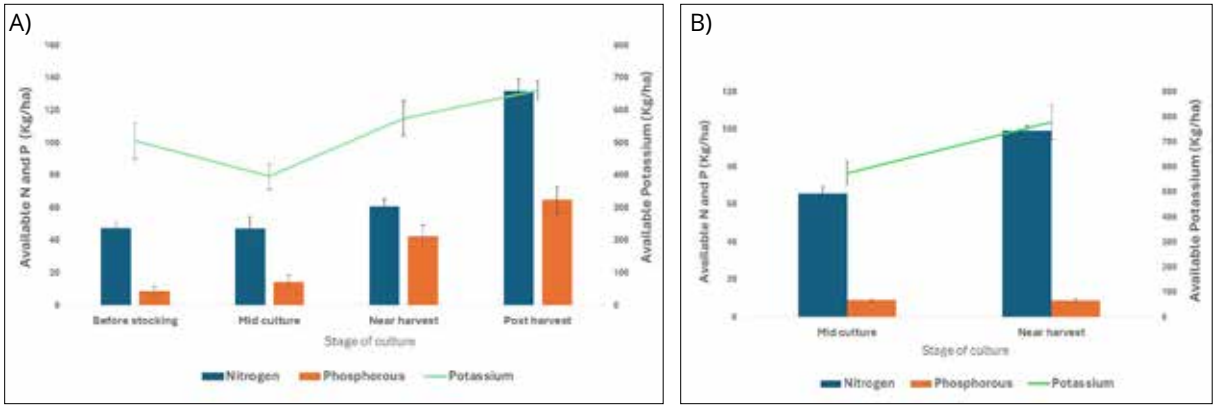
A survey was conducted in Haryana and Rajasthan to assess sulfate concentration in inland saline groundwater and during shrimp culture. Groundwater and corresponding shrimp pond water samples (n = 35 farms) were collected and analysed from the same bore sources. The salinity of groundwater ranged from 4.5 to 32 ppt, while shrimp pond water ranged from 5.5 to 24 ppt. The sulfate equivalence, contribution of sulfate ions to total dissolved solids (TDS), and absolute sulfate concentrations did not differ significantly between groundwater and pond water. The study concludes that high sulfate levels present in inland saline groundwater persist during shrimp farming, with aqueous sulfate ions remaining at concentrations comparable to the source water.



Sulfate equivalence (%) and aqueous sulfate levels in inland saline groundwater and shrimp pond water

Assessment of nutrient dynamics in different aquaculture systems of Sundarbans

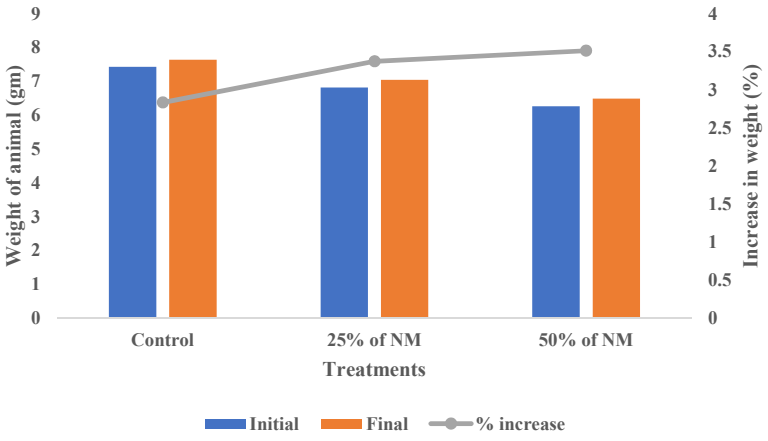
The study was conducted in the Kakdwip, Namkhana, and Patharpratima blocks of South 24 Parganas to evaluate sediment nutrient dynamics and water quality in semi-intensive shrimp farms (*Penaeus vannamei*) and brackishwater traditional polyculture ponds (Bheri) following mixed farming of *L. calcarifer, P. monodon, M. gulio, L. parsia, M. monoceros* etc,. Surface sediments (0–15 cm) were collected before stocking, mid-culture, near harvest, and during post-harvest from shrimp ponds (n=12). Under polyculture, samples were collected during mid-culture and near harvest (n=4). Soils were analysed for available N, P, K, organic carbon, and pH using standard procedures. Shrimp culture ponds showed wider pH variation (7.02–8.60) than polyculture ponds (7.68–8.12). During the culture period, available nutrients and organic carbon increased progressively in shrimp systems due to feed deposition. The organic carbon content increased from 1.45-1.73% during the course of shrimp farming. Polyculture ponds exhibited a steady nutrient rise and greater stability. Mid-culture water showed ionic enrichment with reduced dissolved oxygen, whereas near-harvest water showed higher nitrogen buildup.



Changes in soil N, P, K, and organic carbon dynamics during different stages of A) shrimp farming and B) polyculture farming systems.

Evaluation of the efficiency of liquid nanominerals in shrimp culture

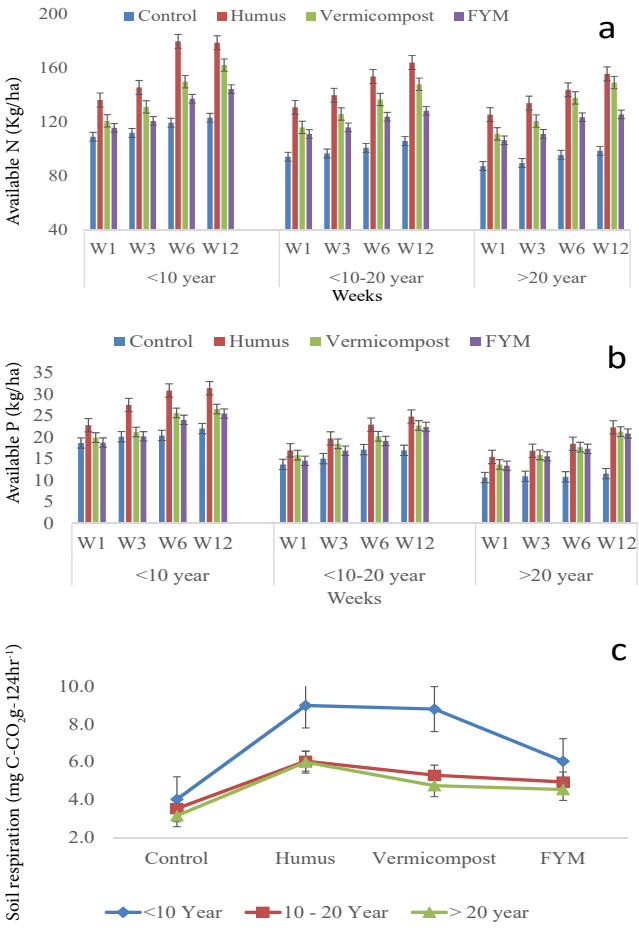
Nano forms of calcium, magnesium, and potassium were prepared in liquid form to mitigate mineral deficiencies in low saline and inland saline water. The size of the mineral was reduced to nano size by a biological agent, and the SEM analysis showed that the sizes of calcium, magnesium and potassium were 100, 100, and 50 nm, respectively. A yard experiment was conducted with *Penaeus vannamei* at 0 ppt salinity to evaluate the nanomineral efficiency in culture water. Four treatments were bulk mineral application of calcium, magnesium, and potassium at concentrations of 12, 40, and 10 ppm, respectively (Control); 25% nanomineral application (T1); 50% nanomineral application (T2); and 75% nanomineral application (T3). Enhanced growth was 19.1 and 24 % under 25% and 50% nano mineral application respectively, compared to the control. Water with 75% nano mineral application was highly turbid and leads to mortality. However, the availability of nano minerals in large quantities and its cost effectiveness are limiting factors to their field usage.



Effect of liquid nanominerals on shrimp growth

Organic amendments for the improvement of soil quality in aged shrimp culture ponds

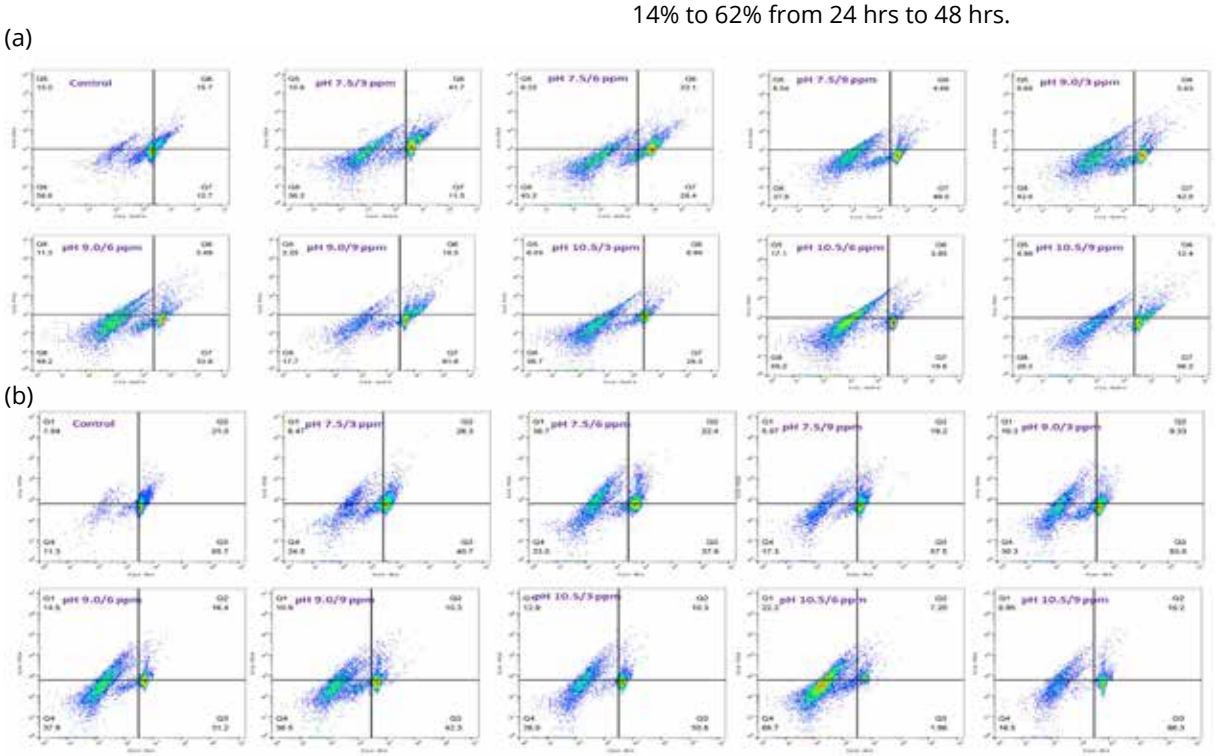
Pond ageing results in deterioration of soil fertility, microbial activity and thereby reduction in shrimp production. With the objective of enhancing the soil quality, three organic amendments, viz., humus, vermicompost, and farmyard manure (FYM) were applied to shrimp culture ponds of varying age (<10, 10-20, and > 20 year), and soil properties were assessed at weekly intervals. Humus application increased the microbial activity by 55, 41, and 48%, soil respiration from 4 to 8.5, 6, and 5.8 mg C-CO_2 g^{-1} $24hr^{-1}$, and available nitrogen by 31, 35, and 37% in <10, 10-20, and > 20-year age ponds, respectively, compared to the control. Fluorescein diacetate activity (FDA µg g^{-1} soil h^{-1}) increased from 45 to 68, 56, and 50, and 98, 90, and 84 with humus, vermicompost, and FYM in >20 and <10 years ponds, respectively. Humus was found to be more effective, followed by vermicompost and FYM in enhancing the soil quality.



Effect of organic amendments application on a) available nitrogen, b) phosphorus and c) soil respiration of varying aged ponds

Effect of pH and ammonia concentration on respiratory burst and apoptotic responses in Whiteleg shrimp using Flow Cytometry

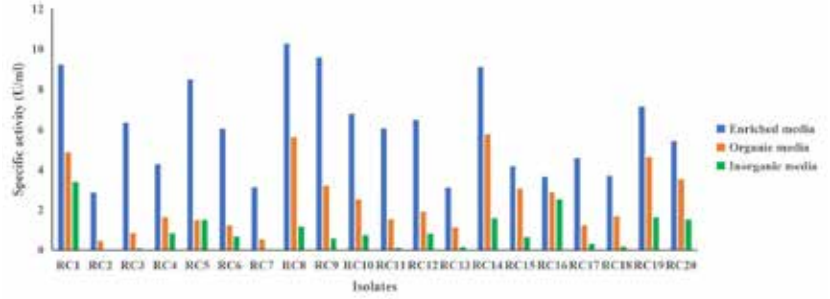
Penaeus vannamei were exposed to pH levels of 7.5, 9.0, and 10.5, and ammonia concentrations of 3, 6, and 9 ppm in combination. Haemolymph collected from each animal at 24, 48, and 96 hrs was subjected to flow cytometry analysis for respiratory burst activity and apoptosis. Respiratory burst activity was found to be high at 96 hrs of pH 10.5 with 9 ppm. Apoptosis levels varied significantly between treatments, ranging from approximately 14% to 62% from 24 hrs to 48 hrs.



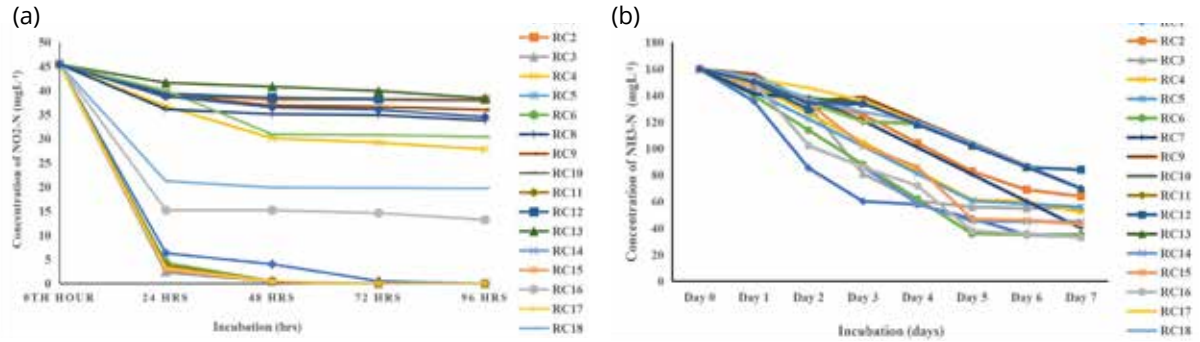
Apoptosis cell percentages of *P. vannamei* exposed to ammonia and pH stress (a) 24 hrs (b) 48 hrs

Multifunctional *Rhodococcus* spp. for simultaneous removal of hydrogen sulfide, ammonia, and nitrite

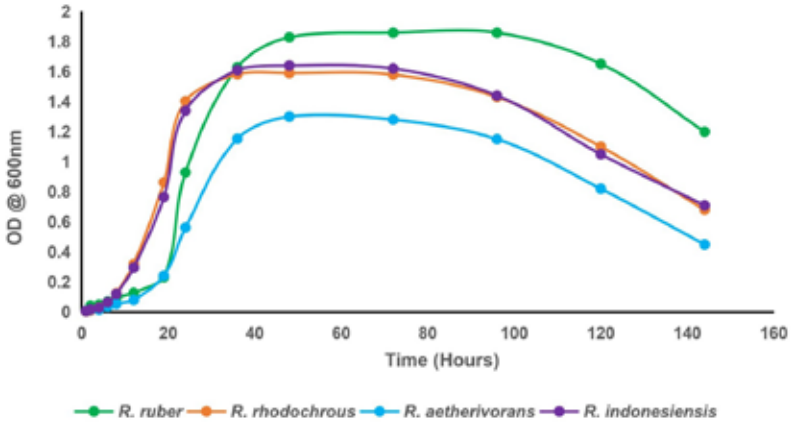
Rhodococcus spp. are promising candidates for the simultaneous removal of the toxic compounds, hydrogen sulfide (H_2S), ammonia, and nitrite in aquaculture systems. A total of 40 samples were collected from aquaculture systems across Tamil Nadu and Andhra Pradesh. Culturable isolates were screened for pH reduction and sulfur oxidation efficiency in enriched, organic, and inorganic media. The isolates having superior sulfur-oxidizing activity and nitrite reduction achieving near-complete removal within 72–96 hours and ammonia reduction by the 7th day were subjected for further analysis. Molecular identification confirmed the strains as *R. ruber*, *R. indonesiensis*, *R. rhodochrous*, *R. aetherivorans*, and *R. electrodiphilus*, and their growth kinetics were determined.



Sulphide oxidase assay of *Rhodococcus* sp. strains in different media.



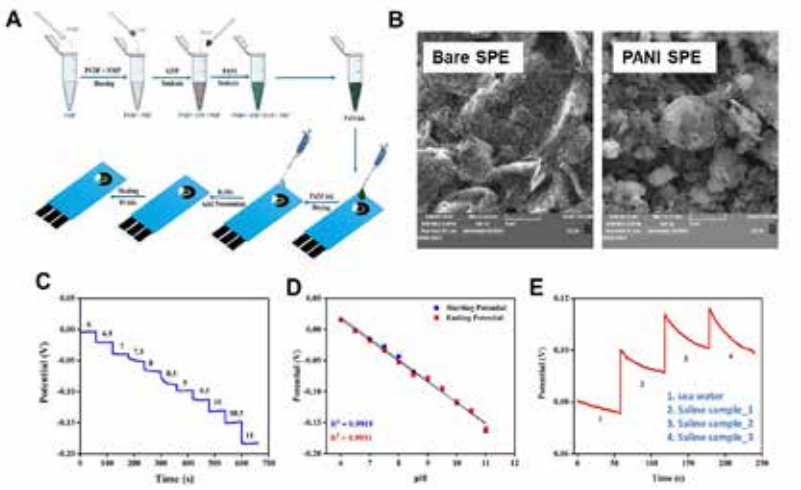
Nitrite reduction (a) and total ammonia (b) reduction by *Rhodococcus* sp. strains



Growth kinetics of *R. ruber*, *R. rhodochrous*, *R. aetherivorans*, and *R. indonesiensis*

Fabrication and characterisation of screen-printed polyaniline-graphene nanocomposite electrochemical pH sensors

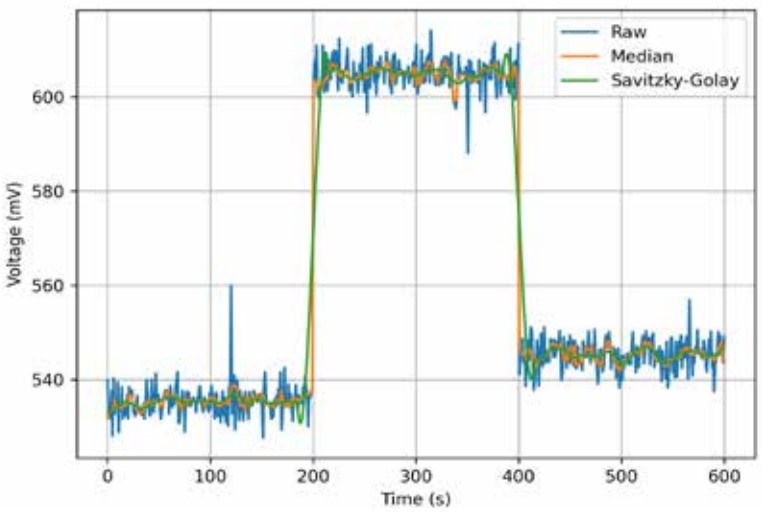
The water pH in aquaculture ponds is vital for the growth of cultured organisms. An alkaline pH range increases toxic ammonia levels, and deviations beyond the optimal range can cause stress or mortality in aquatic organisms, warranting frequent monitoring. Low-cost, portable screen-printed carbon electrodes (SPEs) modified with conductive polyaniline (PANI) were fabricated for water pH measurement, enabling electrochemical pH detection via reversible protonation. The incorporation of graphene nanoparticles (GNPs) improved conductivity, surface area, sensitivity, and overall sensor stability. Successful PANI/GNP modification was confirmed using scanning electron microscope (SEM) images. Sensor performance was evaluated through continuous monitoring using open-circuit potentiometry (OCP) over a pH range of 6–11 at 0.5-unit intervals, following preconditioning in pH 7 and 4 buffer solutions to stabilize the response, which showed linearity. Testing and calibration of the pH sensors in seawater and saline waters demonstrated their practical applicability for aquaculture pond water samples of varying salinity.



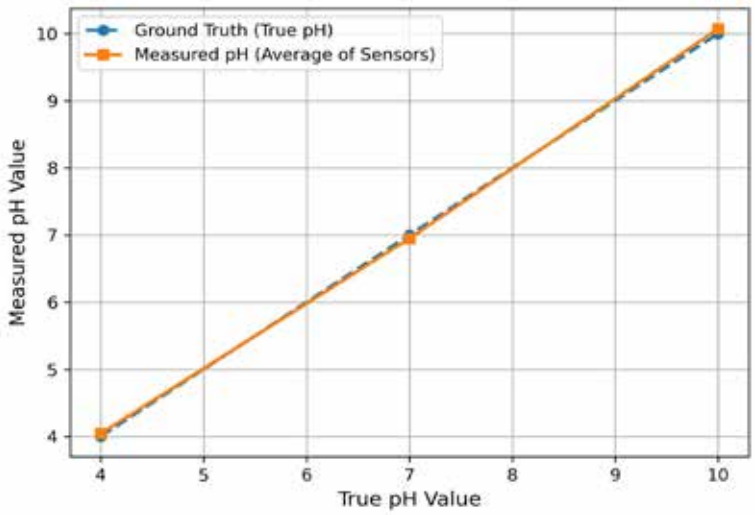
A) Schematic representation of PANI ink synthesis and pH sensor fabrication. B) SEM images before and after PANI coating. C-D) Continuous OCP response from pH 6–11 with calibration plot. E) Real-sample analysis of the developed pH sensor.

Accuracy, signal stability, and repeatability of fabricated electrochemical pH sensors

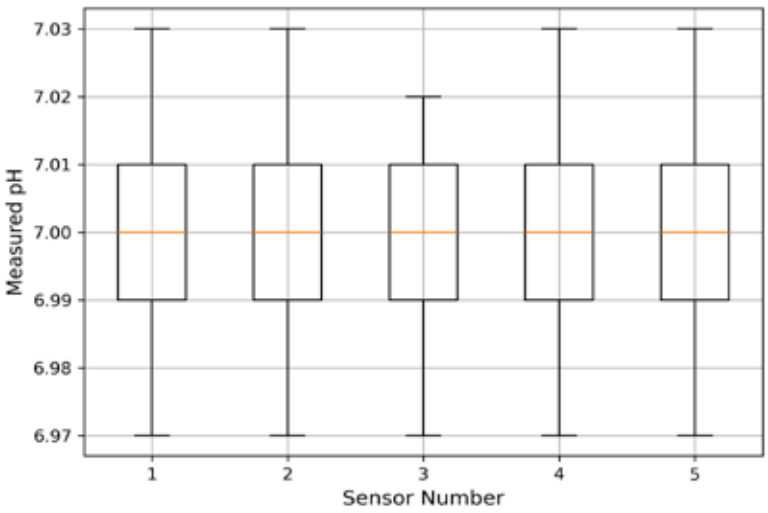
The accuracy and repeatability of five fabricated electrochemical pH sensors were evaluated. Each sensor was calibrated using standard pH buffer solutions, with individual slope and offset corrections applied to account for electrode sensitivity variations and to compute error metrics. Comparison of raw and filtered signals showed that the raw signals contained noticeable noise and sudden spikes due to electrical interference and sensor instability. After applying median and Savitzky–Golay filtering, the signals became smoother, with reduced fluctuations while preserving the original trend, indicating enhanced stability and measurement reliability. Ground truth metrics showed an RMSE of 0.072, an MAE of 0.058, and a mean percentage error of 0.94. Repeatability analysis revealed a maximum deviation of ±0.11 and a standard deviation ranging from 0.018 to 0.026. Overall, the fabricated pH sensors demonstrated reliable accuracy and excellent repeatability for real-time monitoring.



Comparison of raw Vs filtered pH signals



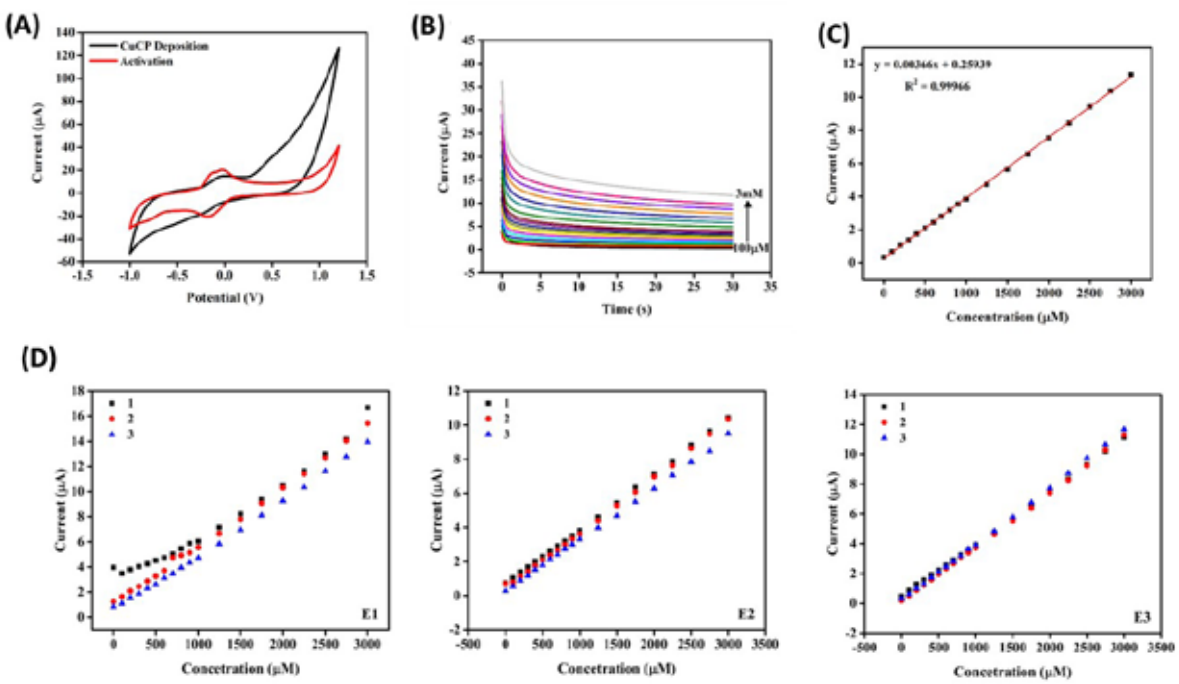
Ground truth validation of pH sensors



Repeatability of pH sensors

Fabrication and performance evaluation of copper porphyrin-based electrochemical nitrite sensors

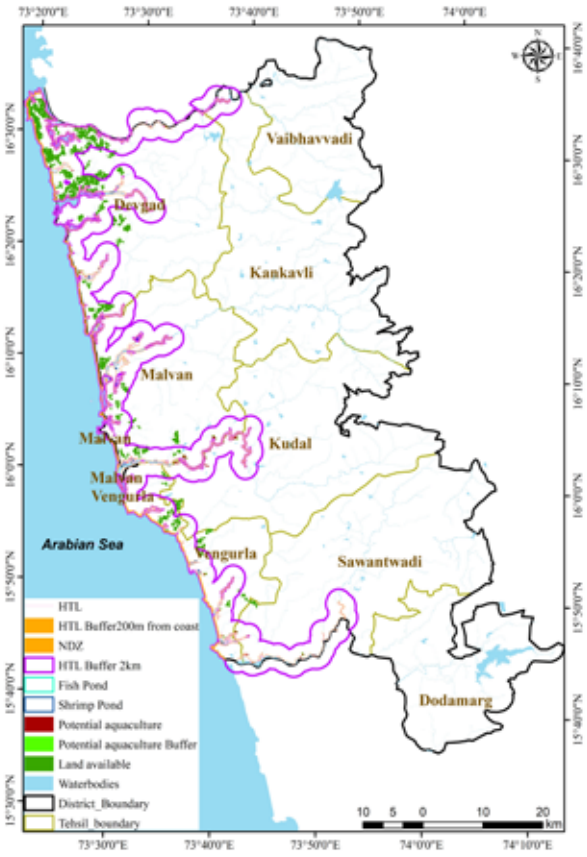
Nitrite is a key water quality parameter in aquaculture ponds, directly influencing the health and survival of aquatic organisms. Copper porphyrin (CuCP)-based materials exhibit strong electrocatalytic activity toward nitrite oxidation, improving sensitivity and lowering detection limits. In this study, cyclic voltammetry (CV) was used for copper electrodeposition and subsequent surface activation to enhance catalytic performance. Chronoamperometry (CA) confirmed the successful deposition and activation of CuCP on screen-printed carbon electrodes (SPCEs). The sensor performance was evaluated over a wide concentration range using CA at an applied potential of 0.8 V, and the calibration curve showed excellent linearity with a correlation coefficient (R^2) of 0.9996. Reproducibility was assessed using three independently fabricated electrodes (E1, E2, and E3), each tested three times under identical conditions across the same concentration range. The consistent responses obtained from nine independent measurements demonstrated the high reproducibility and reliability of the developed nitrite sensor for aquaculture water quality monitoring.



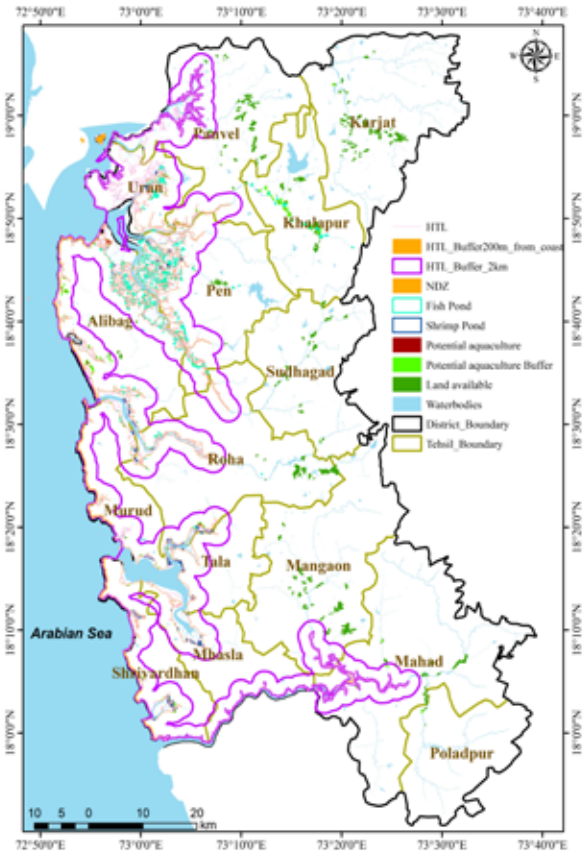
A. CV showing electrochemical deposition of CuCP and electrode activation.
B- C. CA response of the CuCP-modified SPCE for nitrite detection at 0.8 V with calibration plot.
D. Reproducibility scatter plots for three independently fabricated sensors.

Geospatial mapping of potential zones for expanding responsible aquaculture in Maharashtra

This study aimed to identify suitable areas for responsible aquaculture expansion by integrating land-use patterns, water quality parameters of source water, soil characteristics of unproductive lands, CRZ regulations, and CAA guidelines using a geospatial platform. Mapping of existing aquaculture farms and mangrove areas, along with previous land-use patterns, was carried out in all coastal districts of Maharashtra. To identify suitable areas for aquaculture expansion, unused and unproductive lands were mapped in the districts of Palghar, Raigad, Ratnagiri, Sindhudurg, Thane, Sangli, and Kolhapur. Field validation was done to verify the extent and characteristics of each land resource through ground-truth verification. Aquaculture farms and unproductive lands located within 2 km of the High Tide Line and beyond were delineated. Furthermore, the soil characteristics of unused lands and water quality parameters of nearby source water bodies were analysed in the selected districts. Based on these analyses, unproductive lands were identified as potential sites for the expansion of shrimp farming.



Potential aquaculture zones in Sindhudurg district, Maharashtra

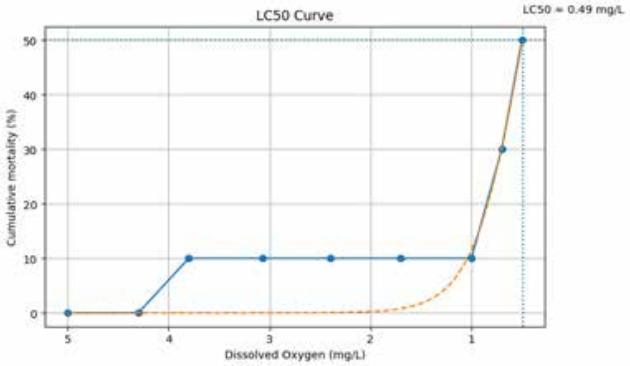


Potential aquaculture zones in Raigad district, Maharashtra

Survival threshold of milkfish under acute hypoxia

Milkfish is a climate-resilient species capable of tolerating a broad range of salinity (0–40 ppt) and temperature (21–34°C), thereby sustaining growth under diverse culture conditions. Understanding the hypoxia threshold of milkfish is critical for optimizing farming practices. The LC_{50} value was determined under acute hypoxic stress in fingerlings (5–8 g body weight). Glass aquaria (34 L) were equipped with nitrogen gas inlets and sealed with plastic sheets to prevent atmospheric gaseous exchange, while aeration inlets were provided for recovery. In two separate trials, the initial dissolved oxygen (DO) concentration of 6 ppm was reduced to 0.5 ppm by passing nitrogen gas over durations of 1 h and 7 h, simulating rapid and gradual DO decline. The LC_{50} values for both exposure durations were calculated to be 0.5 ppm. These findings highlight the remarkable tolerance of milkfish to extreme hypoxia, underscoring its suitability for climate-resilient aquaculture systems.

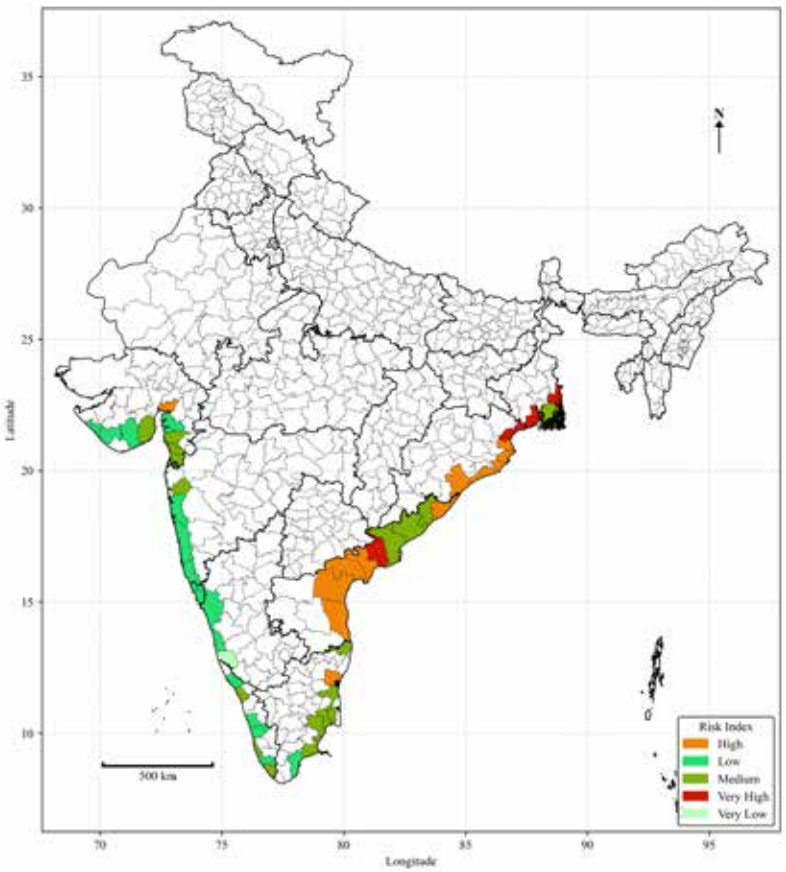
Set up of hypoxia experiment



The LC_{50} value under acute hypoxic stress in milkfish fingerlings

Risk assessment for brackishwater aquaculture to climate change using AR6 frame work

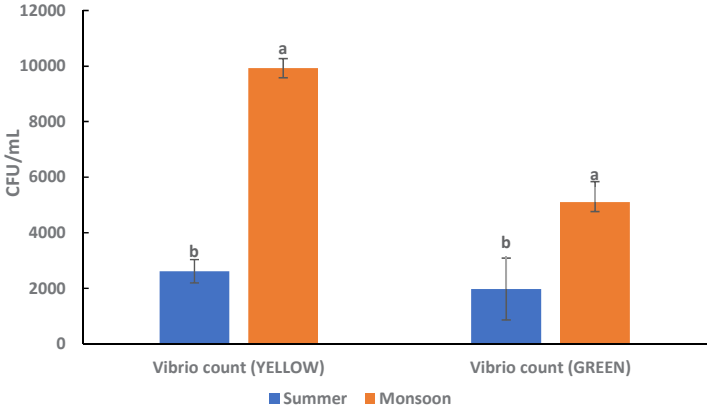
The risk and vulnerability assessment for brackishwater aquaculture with regard to climate change was carried out using the AR6 Intergovernmental Panel on Climate Change (IPCC) framework. Climatic gridded data derived from the RCP 4.5 scenario for future hazards, historical hazard data, along with secondary datasets for exposure and vulnerability indicators, were used for the analysis. A total of 51 coastal districts were evaluated to determine their relative levels of climate-related risk for brackishwater aquaculture. Indicator data were normalized to enable district-wise comparisons. These indices were subsequently integrated into a composite score through expert-based ranking methods. The resulting risk classification demonstrated clear spatial variation, identifying 4 districts as very high risk, 12 as high risk, 18 as medium risk, 16 as low risk, and 1 as very low risk. This systematic categorization provides a structured foundation for prioritizing districts in climate risk management and adaptive planning.



District-wise risk map for brackishwater aquaculture to climate change (AR6 farmework)

Influence of monsoon rainfall on water quality of shrimp culture ponds in the south Gujarat region

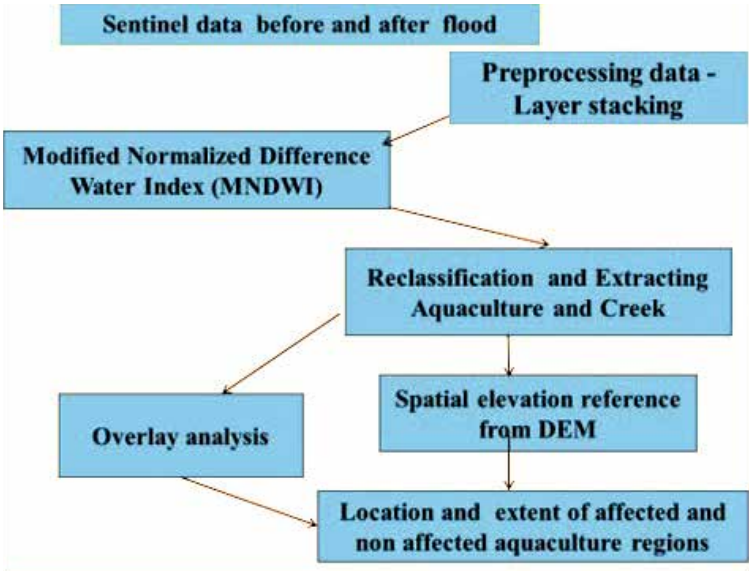
Heavy rainfall causes significant changes in the water quality of shrimp farms. Water samples collected from shrimp ponds (S, n = 63; M, n = 61) in the South Gujarat region during the summer and monsoon seasons were characterized for physicochemical and microbiological parameters. Apart from salinity, pH, and associated parameters that are expected to vary due to dilution, rainfall significantly influenced ammonia, total alkalinity, turbidity, and *Vibrio* loads compared to the summer season. The numbers of yellow and green colonies during the rainy season (Y: 9.92 × 10^3 ± 1113 CFU/ml; G: 5.10 × 10^3 ± 731 CFU/ml) were significantly higher ($p < 0.05$) than those observed during summer (Y: 2.61 × 10^3 ± 420 CFU/ml; G: 1.97 × 10^3 ± 346 CFU/ml). A deeper understanding of the effects of rainfall on changes in shrimp farm water quality is critical for the adoption of BMPs and the prevention of losses.



Vibrio load (CFU/ml) in shrimp farms during the summer and monsoon seasons in South Gujarat

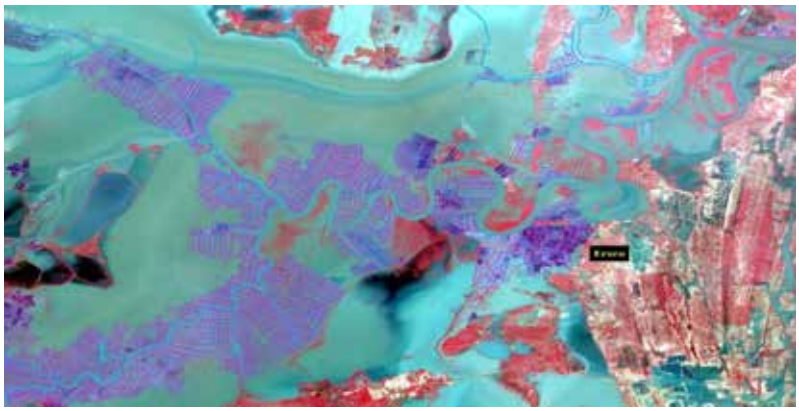
Remote sensing–GIS framework for assessing aquaculture inundation following extreme weather events

A geospatial methodology was developed to estimate aquaculture area inundation using remote sensing and GIS tools and was applied in the Gudur region of Andhra Pradesh following the December 2023 floods triggered by Cyclone Michaung and extremely heavy rainfall. Multitemporal satellite imagery from Sentinel-2B (20 November and 6 December 2023; 10 m spatial resolution) was analyzed to capture pre- and post-event conditions. Elevation data from the Shuttle Radar Topography Mission (SRTM; 30 m resolution) supported a terrain-based flood susceptibility assessment. Image preprocessing, water index generation, change detection, and GIS overlay with aquaculture farm boundaries were performed to delineate inundated areas. Results showed that, out of a total aquaculture area of 5,255 ha, approximately 3,346 ha were inundated. The framework demonstrated a rapid and scalable approach for post-disaster damage assessment of inundated aquaculture areas, enabling evidence-based relief planning, risk mapping, and climate-resilient aquaculture management .



Framework of methodology to assess the inundated aquaculture area

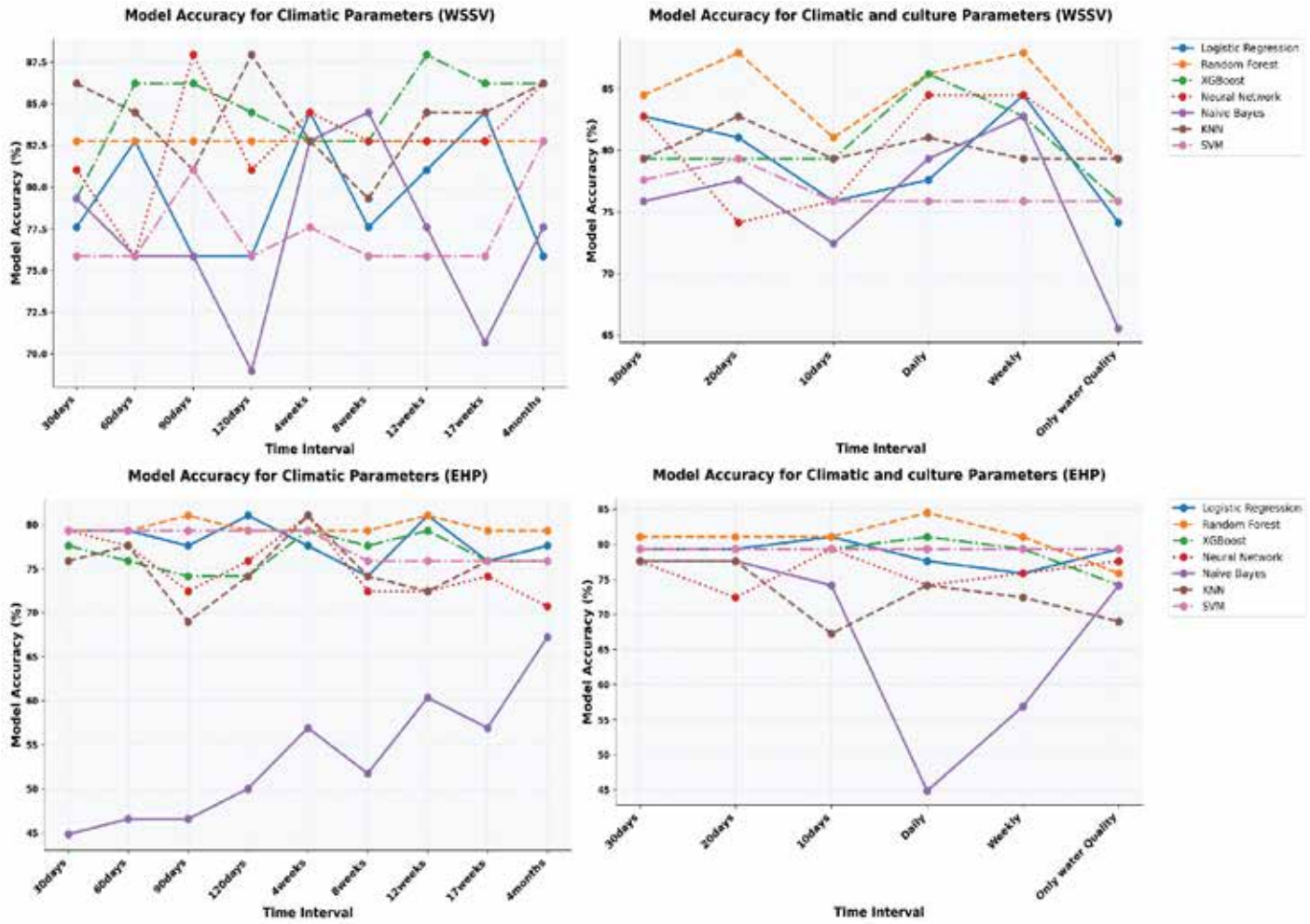
Aquaculture area near Eruru Village



Aquaculture inundated area near Eruru Village

Shrimp disease prediction models using culture and climatic parameters

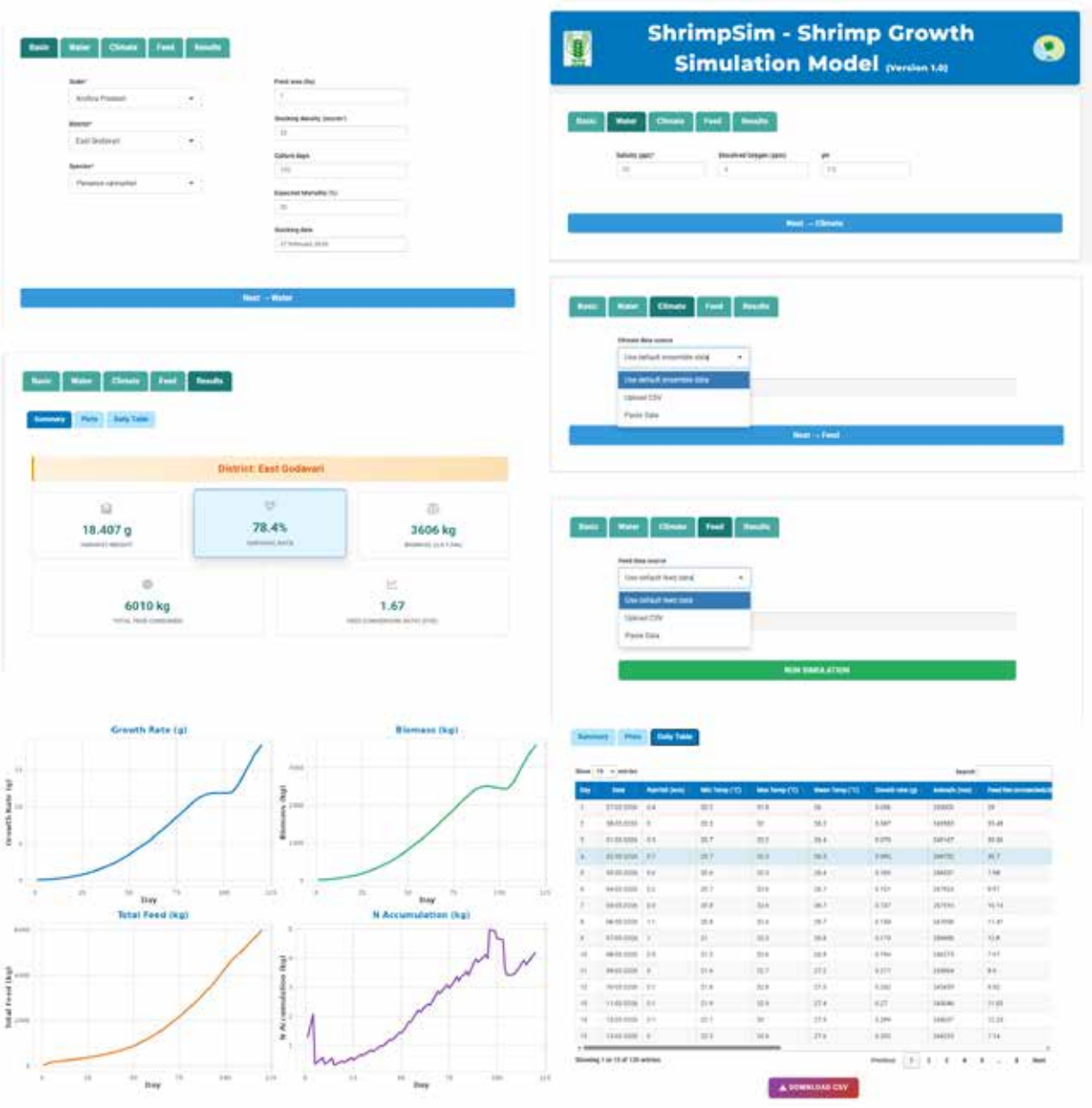
Disease forecasting is highly challenging because disease occurrence results from multiple factors, including climate, water quality, genetics, and management practices. This study evaluated variables such as stocking density, days of culture, water quality, rainfall, and maximum and minimum temperatures from 290 farms across Tamil Nadu (TN), Andhra Pradesh (AP), and Odisha using seven machine learning models, namely Logistic Regression, Random Forest (RF), XGBoost, Neural Network, Naive Bayes, K-Nearest Neighbour, and Support Vector Machine, for the accurate prediction of two diseases, WSSV and EHP. RF, followed by XGBoost, consistently emerged as the most reliable model for disease prediction, and the integration of culture parameters, water quality, and climate data improved predictive accuracy. Testing the models at different time intervals revealed that four weeks of weekly climate data were sufficient for reliable forecasting. Integrating culture and climate information offers an effective decision-support tool for disease forecasting and management in shrimp farming.



Accuracy of machine learning models built for prediction of WSSV and EHP

ShrimpSIM: Shrimp growth simulation model

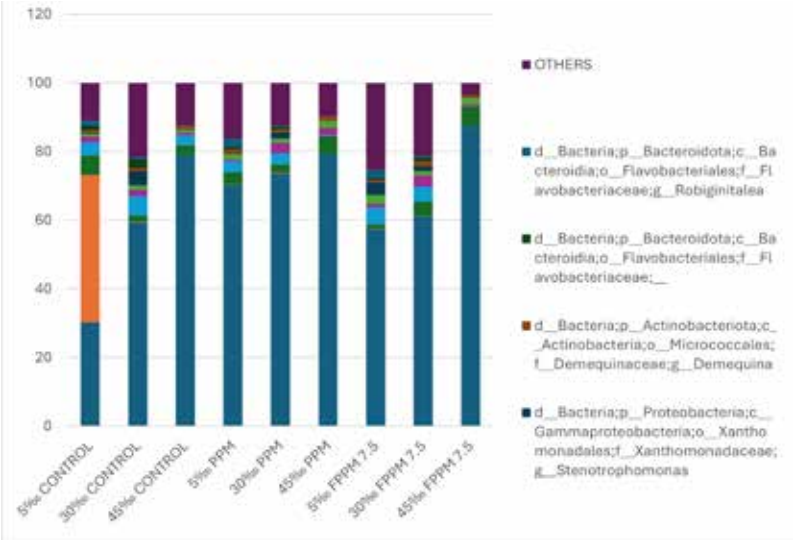
System dynamics models were developed to predict shrimp growth in grow-out culture systems. Models were created for two shrimp species, *Penaeus vannamei* and *Penaeus monodon*, tracking shrimp from an initial weight of 0.056 g to approximately 35 g over the entire culture period. The model integrates growth dynamics, biomass accumulation, survival, feed utilization, and nitrogen waste, along with changing daily surface weather parameters and feeding regimes. Growth follows the Gompertz function and is adjusted for temperature anomalies, with optimal growth at 28°C and sharp reductions below 15°C or above 38°C. Heavy rainfall exceeding 50 mm/day further slows growth by altering salinity and pH. Survival is influenced by environmental stressors and climatic extremes. An easy-to-use web app, named ShrimpSIM version 1.0, was developed using R Shiny and integrated with an Apache web server. This web app enables users to run simulations using user-defined input parameters.



Snapshot of ShrimpSim web tool

Effects of climate-resilient functional feed and salinity stress on the gut microbiome of Whiteleg shrimp

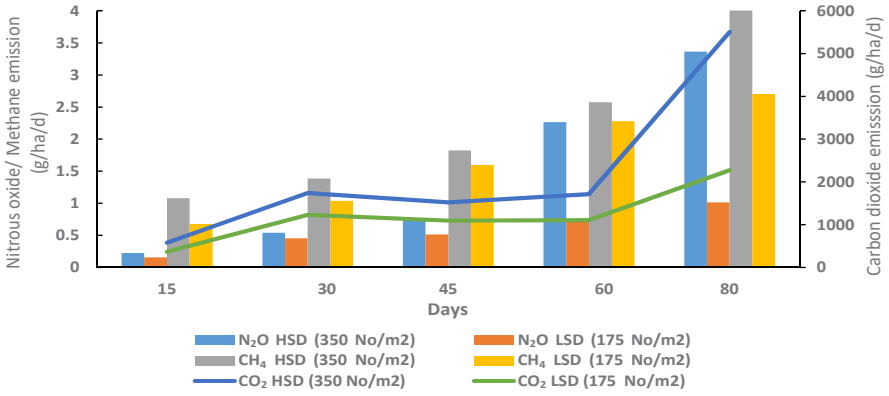
The study evaluated the effects of fermented plant protein diets on the gut microbiome of *Penaeus vannamei* reared under varying salinity conditions. Shrimp were cultured at three salinity levels: 30‰ (control), 45‰ (high), and 5‰ (low). Four iso-nitrogenous diets were tested: a control diet, a plant protein mix (PPM), a fermented plant protein mix with 7.5% inclusion (FPPM 7.5), and a fermented plant protein mix with 10.5% inclusion (FPPM 10.5). Each dietary treatment was randomly assigned in triplicate, and the feeding trial was conducted for 45 days. Gut microbiome analysis revealed that the relative abundance of the phylum *Proteobacteria* increased progressively with rising salinity levels, irrespective of dietary treatment. Within this phylum, the genus *Serratia* was predominant in shrimp fed FPPM 7.5 at higher salinities. Certain *Serratia* strains are known for their probiotic properties, potentially contributing to improved digestion, microbial balance, and immune modulation in shrimp.



Effect of functional diet on salinity in gut microbiome at the genus level

Greenhouse gas emissions from the super-intensive precision and natural shrimp farming (SIPNSF) system

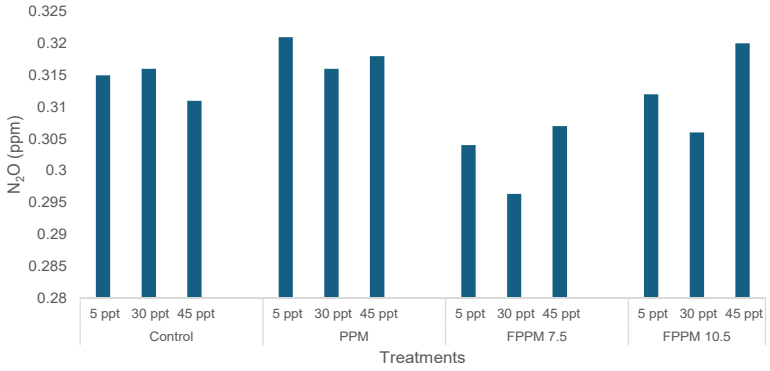
An inventory of greenhouse gas (GHG) emissions from shrimp culture systems is essential for carbon credit generation and trading. ICAR-CIBA successfully demonstrated SIPNSF technology at varying stocking densities. The environmental sustainability of SIPNSF was evaluated in terms of global warming potential (GWP) at two stocking densities: 175 and 350 no./m³. GHG fluxes were collected in Tedlar bags using a floating chamber on different days of culture and quantified by gas chromatography. Methane and nitrous oxide emissions ranged from 0.68 to 2.7 and 1.08 to 4.17 g/ha/day, respectively, at the high stocking density, and from 0.16 to 1.0 and 0.22 to 3.36 g/ha/day, respectively, at the low stocking density. Overall GHG emissions, expressed as average GWP (g CO_2 eq. per kg shrimp), were lower for SIPNSF (0.9 and 1.1 at low and high stocking densities, respectively) than those reported for conventional earthen pond systems (2.6–3.8), indicating improved environmental sustainability.



Greenhouse gas emissions from the SIPNSF system varying in stocking density

Effect of functional feed on greenhouse gas emissions in Whiteleg shrimp under different salinity conditions

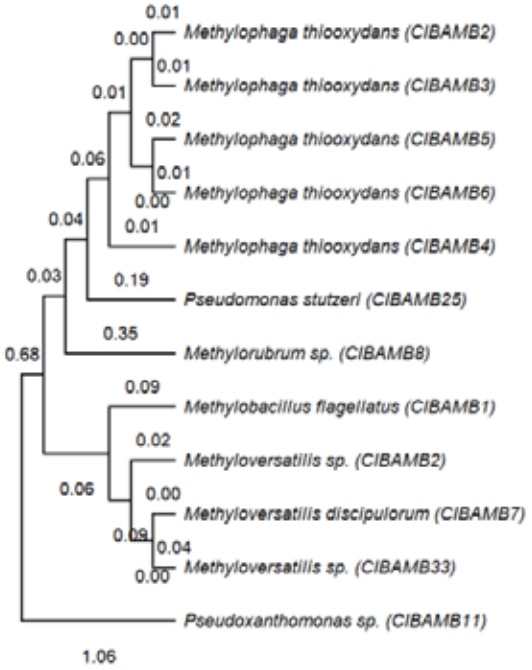
Functional diets were formulated to mitigate salinity-induced abiotic stress in *Penaeus vannamei*, and their effects on greenhouse gas (GHG) emissions were evaluated. Shrimp were reared under three salinity regimes: 30 ppt (control), 45 ppt (high), and 5 ppt (low). Two functional diets containing fermented plant protein mix (FPPM) at inclusion levels of 7.5% and 10.5% were tested. GHG emissions, including nitrous oxide (N_2O), methane (CH_4), and carbon dioxide (CO_2), were monitored to assess environmental impacts. Results demonstrated that N_2O emissions were significantly reduced in shrimp fed the FPPM 7.5 diet across salinity treatments, suggesting improved nitrogen utilization and reduced nitrification–denitrification losses. In contrast, CH_4 and CO_2 emissions did not differ significantly among dietary treatments. These findings indicate that fermented plant protein inclusion, particularly at 7.5%, can contribute to lowering nitrous oxide emissions and support environmentally sustainable shrimp culture under varying salinity conditions.



Effect of fermented feed on N_2O emissions at different salinities

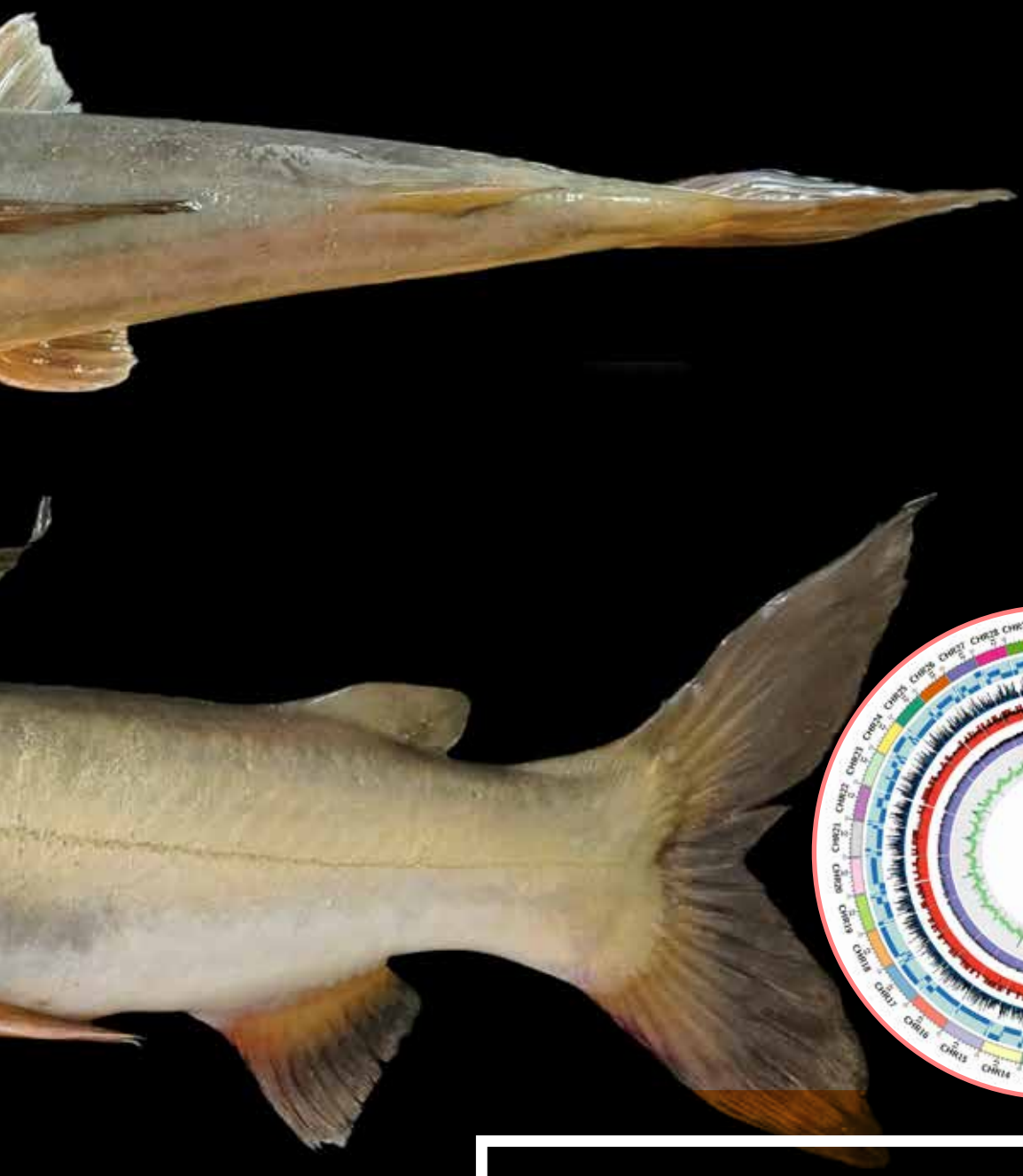
Phylogenetic diversity of bacterial communities involved in greenhouse gas mitigation

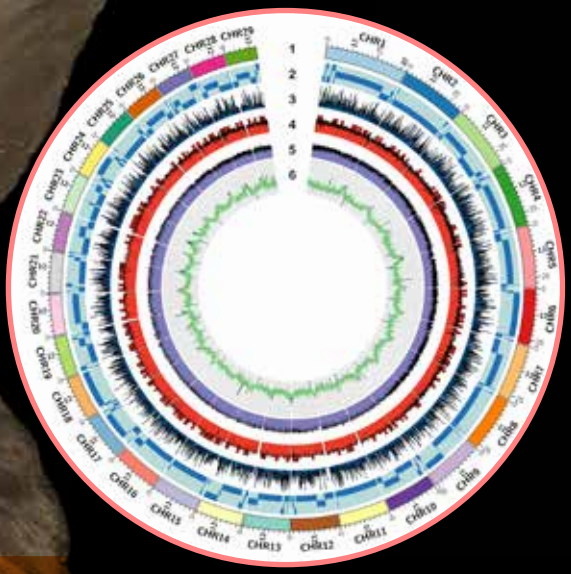
Methanotrophic and other bacteria involved in greenhouse gas mitigation were isolated from sediment samples collected from brackishwater ecosystems, including shrimp culture ponds, backwaters, estuaries, and mangroves, across salinity gradients in Tamil Nadu, Andhra Pradesh, and West Bengal. The sediments were enriched in nitrate mineral salts medium to selectively promote the growth of methane-oxidizing and associated bacteria. Molecular characterization based on partial 16S rRNA gene sequencing was performed to determine the phylogenetic relationships among the isolates. Phylogenetic analysis revealed that the methanotrophic and related bacterial communities were distributed across six genera: *Methylobacillus, Methylophaga, Methyloversatilis, Pseudoxanthomonas, Pseudomonas,* and *Methylorubrum*. The constructed phylogenetic tree demonstrated distinct clustering patterns, reflecting ecological adaptation to varying salinity conditions. These findings highlight the diversity of methane-utilizing and associated bacteria in brackishwater sediments and their potential role in mitigating greenhouse gas emissions in coastal aquaculture.



Phylogenetic relationships among methanotrophic and associated bacterial communities

06



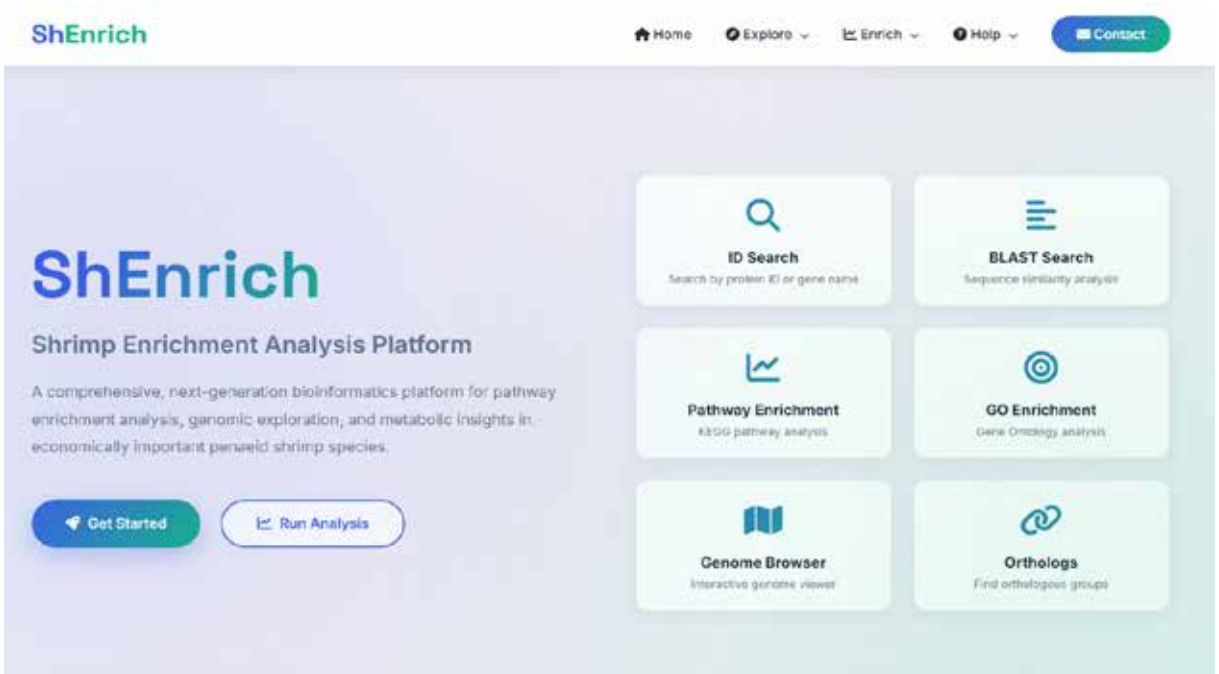


Genetics and Biotechnology

Genetics and Biotechnology

ShEnrich: A species-specific annotation and enrichment analysis platform for Penaeid shrimp

Penaeid shrimps lack robust annotation platforms like the ones available for model organisms forcing researchers to rely on generic tools that fail to capture crustacean-specific biology systematically. In this context, ShEnrich, the first comprehensive functional annotation database and enrichment platform was developed for five commercially important Penaeid species (*Penaeus vannamei, Penaeus monodon, Penaeus chinensis, Penaeus indicus* and *Penaeus japonicus*). The resource integrates 61,287 annotated proteins representing 34,130 genes across five species with curated KEGG pathway and Gene Ontology assignments spanning 442 pathways and 12,897 GO terms. Annotations were generated through a phylogenetically informed, multi-tiered pipeline employing crustacean-restricted homology searches, domain predictions, and ortholog mapping prioritizing evolutionarily relevant functional assignments. Comparative genomics is enabled through 18,031 ortholog groups across all five species. The integrated web platform provides ready-to-use enrichment workflows, searchable annotations, genome visualization, and downloadable results in standard formats. ShEnrich is available at https://bioinfo.ciba.res.in/shenrich/



User interface of ShEnrich webtool.

A simple sequence repeats (SSRs) marker database for shrimp

The SSRs or microsatellites are co-dominant markers with high abundance in invertebrate genomes. The SSRs have potential applications to population genetic analyses, heterozygosity assessment and parentage assignment in breeding programs. In this regard, a shrimp SSR database was developed for five shrimp species, *Penaeus indicus*, *Penaeus japonicus*, *Penaeus vannamei*, *Penaeus chinensis*, and *Penaeus monodon* which serves as ready-to-use data with SSR markers and the associated primer information. Briefly, the genome assemblies of shrimp were analyzed using Krait, MISA, and GMATA tools. The marker set that is consistently reported by all three tools were incorporated to database. The database contains 44,856,376 SSRs among shrimp along with the primer sequence information. The users can extract markers based on motif type, repeat motif sequence, genomic region, chromosome, amplicon length, melting temperature etc. The SSR markers database serves as a significant resource for breeding programs in these economically important *Penaeus* species.

The number of SSR markers predicted for shrimp species

Species	Assembly accession	SSR Count			
		GMATA	MISA	KRAIT	Consensus
Penaeus indicus	GCF_018983055.1	1,04,26,904	1,00,93,355	1,04,52,525	98,81,261
Penaeus japonicus	GCF_017312705.1	1,04,28,418	99,21,999	1,03,95,284	98,97,082
Penaeus vannamei	GCF_042767895.1	1,07,34,851	1,02,06,142	1,07,03,967	1,01,76,164
Penaeus chinensis	GCF_019202785.1	84,14,230	80,57,405	83,90,084	80,37,251
Penaeus monodon	GCF_015228065.2	70,95,485	68,73,587	70,80,563	68,64,618

Standardized PIT (Passive Integrated Transponder) tagging protocol for shrimp

A study to understand the effects of PIT tags on mortality was conducted in adult *P. indicus* (23-28 g) shrimp. The tags were inserted into three different locations (Segment 1, 5 and 6) in the abdominal muscle and observed for 45 days. MiniHPT8™ PIT tags (8.4 mm × 1.4 mm) were used and detected with an HPR LITE tag reader. Low mortality was observed (≤ 10 %) across all treatments with no significant difference in mortality rates among the three different tagging positions. During this period, two molting events were observed, with no mortality, no signs of infections and no tag ejection. These results demonstrate that PIT tagging is a reliable method for individual identification and growth monitoring of shrimp during communal pond rearing and is suitable for selective breeding programs.

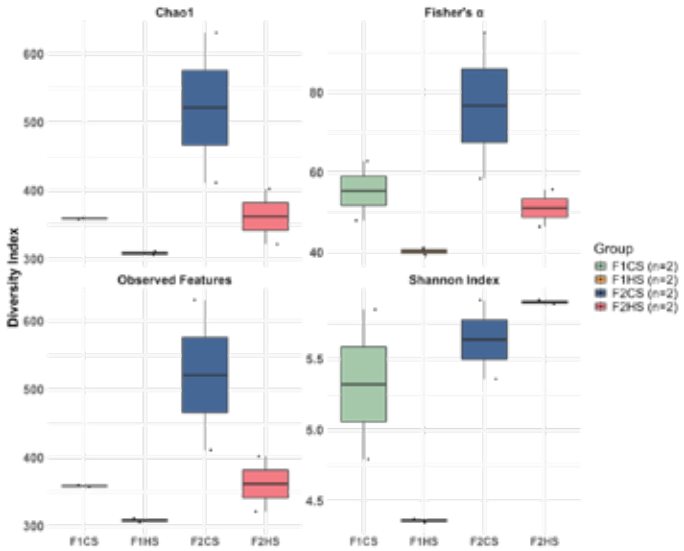
Image displaying reading of PIT tag positioned in shrimp tail

Development of SSR marker panel for Indian white shrimp

A chromosome-scale genome assembly of *Penaeus indicus* comprising 44 scaffolds was utilized for the development of microsatellite markers. Using the GMATA pipeline, 350 SSR primer pairs targeting tri-, tetra-, penta-, and hexa-nucleotide repeat motifs were designed. Four loci per scaffold were initially screened using samples collected from five geographically distinct populations along the Indian coast: Chennai (Kovalam), Kollam, Sirkazhi, Kanyakumari, and Visakhapatnam. Species identity was confirmed through COI gene sequencing. Based on amplification efficiency and polymorphism, 24 highly informative SSR loci were selected, with one locus retained per scaffold to minimize linkage disequilibrium. The selected markers exhibited high levels of polymorphism, with 6–37 alleles per locus (mean = 22.64) and polymorphic information content (PIC) values ranging from 0.786 to 0.966. These markers were assembled into six multiplex SSR panels and will be employed to evaluate genetic diversity, population structure, and connectivity among wild *P. indicus* populations. In addition, they provide a valuable genomic resource for monitoring genetic variation and estimating inbreeding levels in future selective breeding and stock improvement programs.

Intestinal microbiota of Indian white shrimp reveals the importance of high-lipid diets under high-salinity conditions

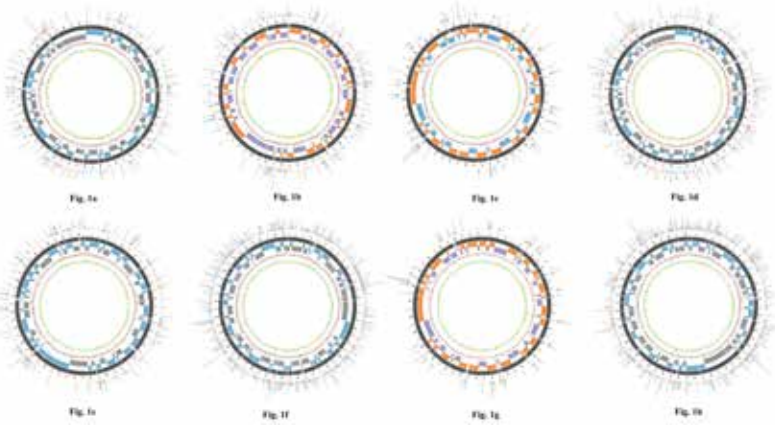
Recent studies on metagenomics highlight the strong correlation between gut microbiota and shrimp health. Variations in water salinities cause stress to the animals. In this study, impact of high salinity and high lipid diet on the gut microbiota of *Penaeus indicus* was assessed. Taxonomic profiling indicated the dominance of *Ruegeria*, *Celeribacter*, *Allobaculum*, *Blautia*, *Sungkyunkwania* and unclassified *Rhodobacteraceae* across the samples. Alpha diversity indices of the treatment groups displayed a fall in species diversity under hyper-saline conditions and an upsurge with high lipid diets compared to the control group. Functional prediction of the microbial communities indicated the abundance of energy-yielding pathways and the pathways associated with biosynthesis and elongation of long-chain fatty acid molecules, an important component of cellular and organellar membranes. Overall, the study demonstrated the role of intestinal microflora in *P. indicus* in regulating energy homeostasis under high saline conditions with high lipid content in feed.



Comparison of alpha diversity indices (a) Cho1 index (b) Fisher alpha index (c) Observed features index and (d) Shannon's index. CS = Control Salinity; HS = High Salinity; F1 = control feed; F2 = High-lipid feed.

Variation among WSSV isolates through comparative genomics approach

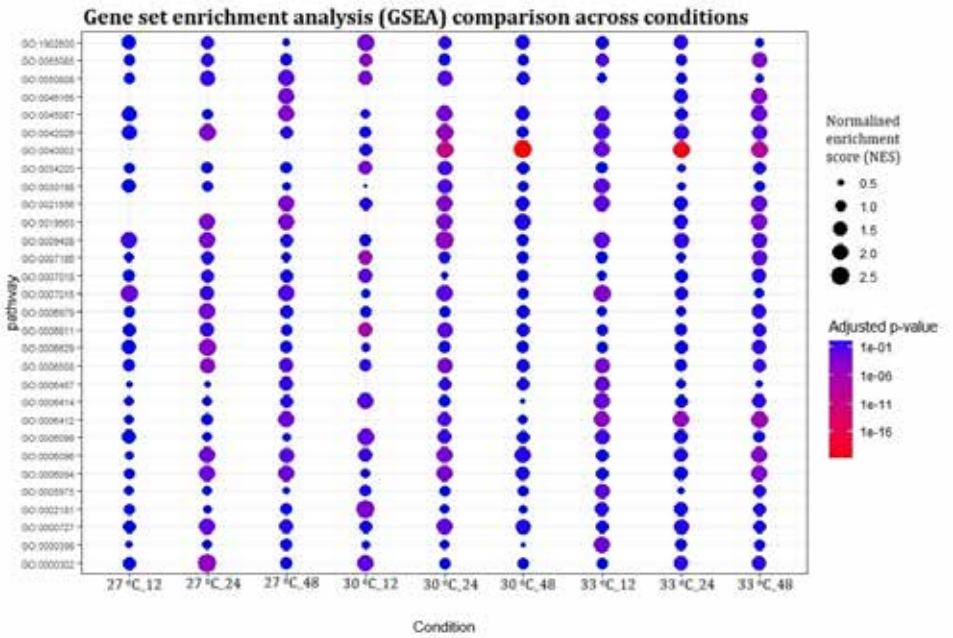
Earlier, we have documented the genome-wide deletion profiles among various ICTV-recognized WSSV isolates through comparative genomics analyses conducted with Missing Regions Finder software. Based on the specific deleted genomic regions primers were designed to identify WSSV isolates. In continuation to earlier study, 49 WSSV infected *Penaeus indicus* shrimp samples were analysed this year with specific primers for genotyping, which revealed the presence of several isolates. The samples were further sequenced to generate full virus genome sequence. Overall, the sequence assembly of the 8 isolates of WSSV revealed a genome length ranging from 277,428 bp (Taiwan) to 282,694 bp (India) and the GC content was highly conserved across all isolates varying between 41.08% and 41.11%.



Circos plots of assembled WSSV isolates (a) CN02 (China); (b) CN03 (China); (c) CN04 (China); (d) CN-Pc (China); (e) EC-15098 (Ecuador); (f) IN_AP4RU (India); (g) K-LV1 (Korea); (h) TW (Taiwan)

Temperature-dependent transcriptional changes in WSSV infected Indian white shrimp

White spot syndrome virus infected *Penaeus indicus* at different temperatures (27°C, 30°C, and 33°C) and hours post-infection (hpi) (12, 24, and 48 hpi) revealed distinct transcriptomic responses. At 27°C–12 hpi, highly upregulated genes were mainly associated with muscle function (troponin C, myosin heavy chain), immune response (hemocyanin, zinc finger protein), and stress response (alpha-crystallin A chain). In contrast, genes related to reproduction (ATP-dependent RNA helicase A), cuticle formation (pro-resilin), and nervous system

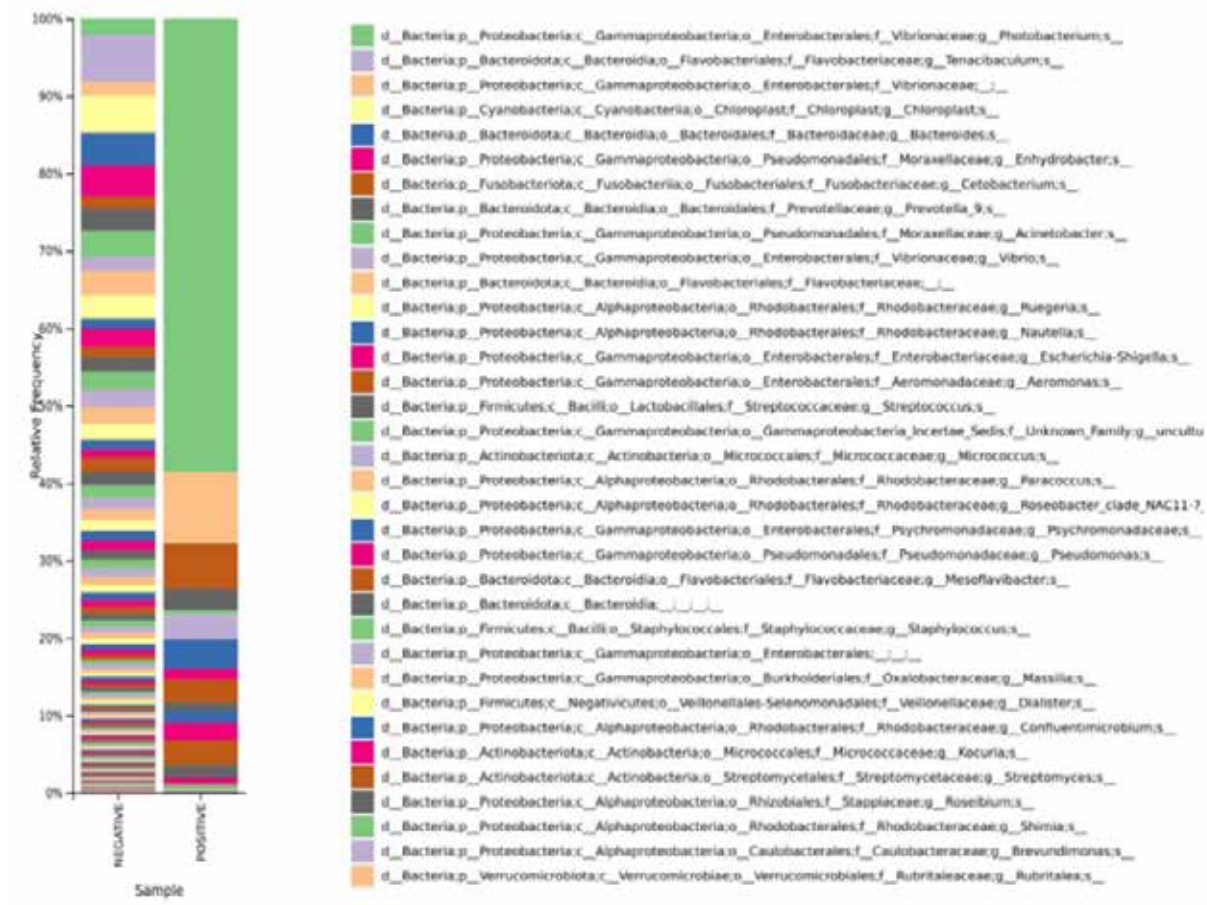


Dot plot showing the enriched GO terms of WSSV infected and control shrimps exposed to different temperatures and at different time points

development (neurotrophin-1) were downregulated. At 27°C–24 hpi, eight genes were significantly upregulated, whereas sixty-four genes were downregulated. Pro-resilin and cuticle protein genes showed significant downregulation at 27°C (24 and 48 hpi) and 33°C (12 hpi). Similarly, cuticle protein genes were downregulated at 24 and 48 hpi at 30°C. Transcriptomic analysis at 30°C–12 hpi showed 11 upregulated and 23 downregulated genes, while 124 upregulated and 94 downregulated genes were identified at 48 hpi. Gene set enrichment analysis highlighted significant enrichment of pathways related to chitin-based cuticle development, heat response, and protein refolding. Moderately enriched pathways included glycolysis, translation, synapse organization, and gluconeogenesis, whereas pathways related to receptor signalling, cytoskeletal movement, and proteolysis showed comparatively lower enrichment.

Gut microbiota disruption in WSSV-infected wild Indian white shrimp

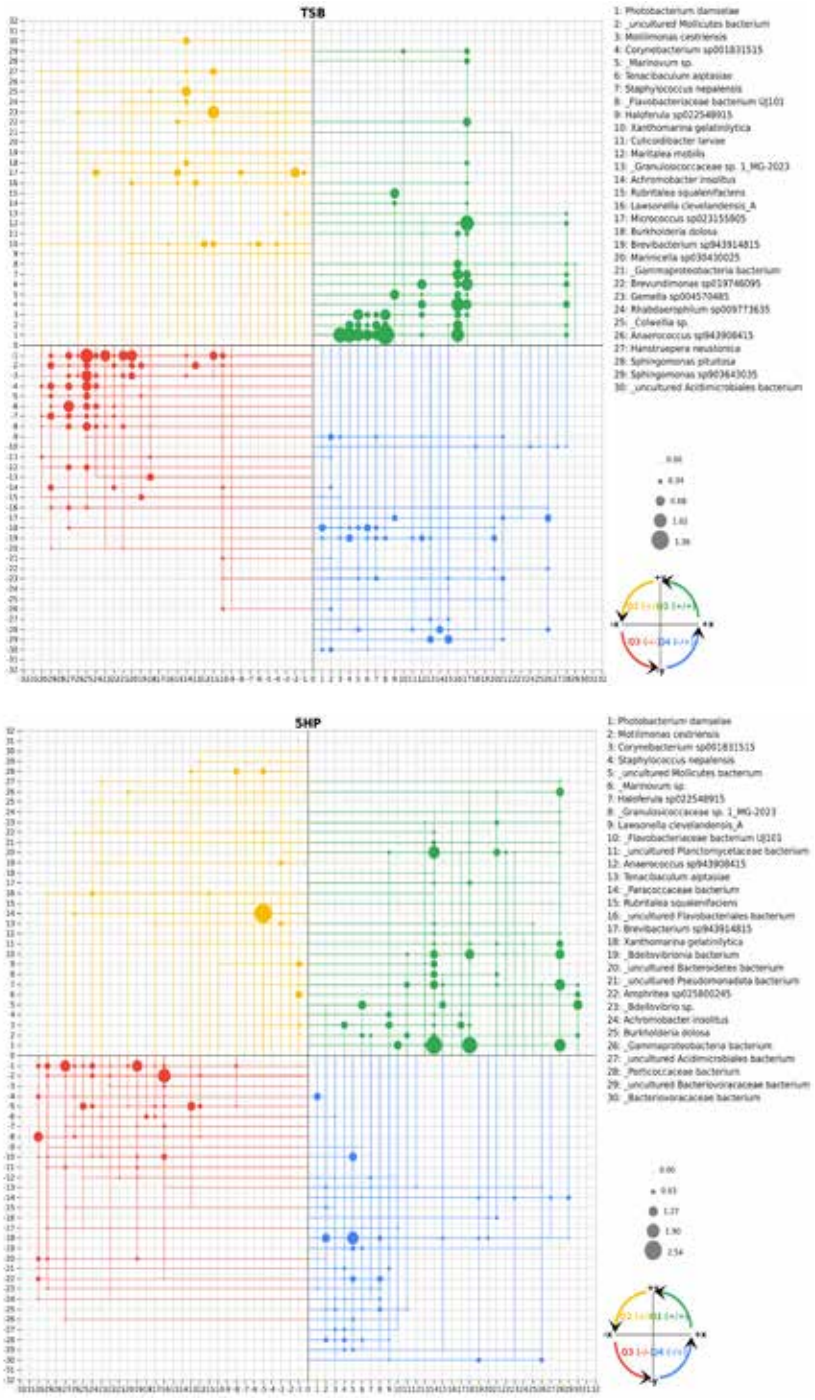
This study analyzed gut microbiota composition in wild-caught *Penaeus indicus* to compare healthy and WSSV-infected individuals and to identify microbial biomarkers and potential probiotic targets. Wild brooders collected from Kakinada and Andhra Pradesh were screened using nested PCR amplification of VP28 and categorized as WSSV-positive (PG) or negative (NG). 16S rRNA metagenomic profiling (Illumina platform) was performed and Operational Taxonomic Units (OTUs) were analyzed using QIIME2 and visualized in R Studio. NG shrimp exhibited a diverse microbiota dominated by beneficial genera such as *Enhydrobacter*, *Acinetobacter*, *Dialister* and *Bifidobacterium* whereas PG shrimp showed a marked dominance of *Photobacterium* (88,100 OTUs vs 556 in NG) alongside increased *Vibrionaceae* and *Escherichia/Shigella*. The loss of commensals and expansion of pathogens indicated microbial dysbiosis caused by virus stress. These findings highlight disrupted microbial homeostasis in WSSV-infected shrimp and suggest potential probiotic and microbial biomarkers for future disease mitigation strategies in aquaculture.



Relative abundance of bacterial genera in WSSV infected and healthy shrimp

Variance-based microbial network analysis reveals microbiome destabilization under disease stress in White legged shrimp

Microbial communities function as complex adaptive systems in which species interactions, not just abundances, shape ecosystem stability and host health. In aquaculture, the shrimp gut microbiome can rapidly reorganize under disease stress, yet most 16S rRNA studies focus only on compositional shifts, overlooking changes in microbial relationships. In this study, we reanalyzed a time-series 16S dataset from *Penaeus vannamei* challenged with pathogenic and non-pathogenic *Vibrio parahaemolyticus* strains. Using a novel slope-based, signed regression approach, we inferred directional ecological interactions and tracked how microbial networks changed over time. Results show that pathogenic stress triggered pronounced rewiring, inversion, and collapse of key microbial interactions, particularly involving *Photobacterium damselae* and Mollicutes bacterium, closely paralleling disease progression and mortality. In contrast, healthy shrimp maintained stable interaction networks. These findings demonstrate that microbial interaction plasticity is a sensitive indicator of microbiome disruption and may serve as an early-warning biomarker for dysbiosis, supporting improved diagnostics and microbiome management in aquaculture systems.



Eco-Cartesian representation of microbial regulatory organization in healthy control (TSB) and pathogenic *Vibrio*-challenged (5HP) shrimp microbiomes. The TSB network exhibits denser and more stable microbial connectivity, indicating a balanced and coordinated microbial community structure. In contrast, the 5HP network shows reduced connectivity, fragmented organization, and altered regulatory patterns, reflecting microbiome plasticity and instability under disease stress. Microbial taxa are arranged according to their inferred regulatory influence and responsiveness, while edge size represents the strength of association. The quadrant-based layout provides a simplified system-level visualization for comparing microbiome stability and condition-specific structural changes.

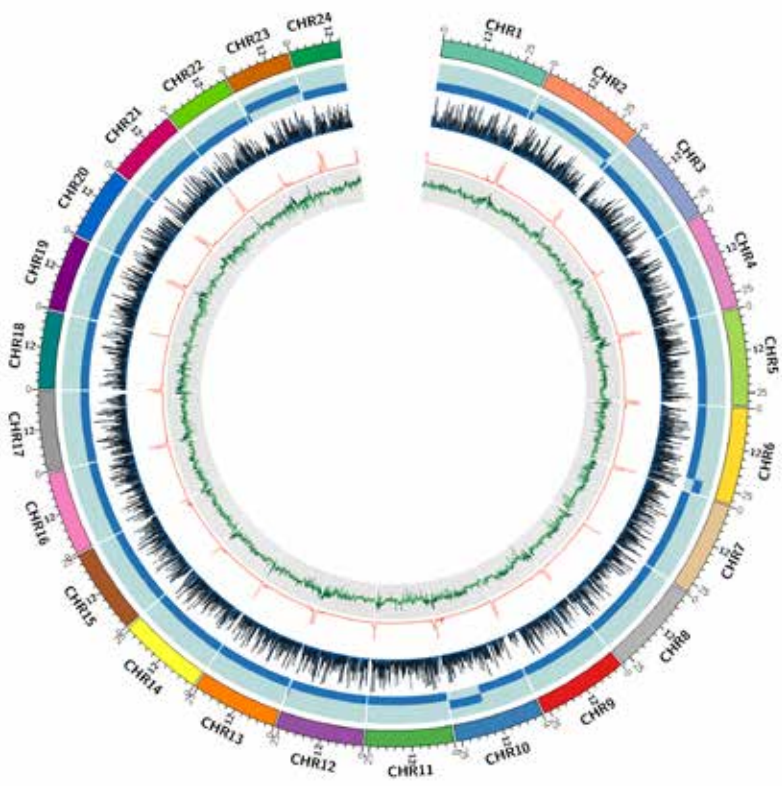
Pan-genome analysis of probiotic and halo-tolerant bacteria

Halotolerant bacterial species like *Bacillus paralicheniformis, B. licheniformis, and B. amyloliquefaciens* are being used in probiotic formulations. Pangenome analysis was conducted with 189 strains belonging to these three species to understand their genomic profiles. Complete genome assemblies of these strains were retrieved, annotated using PGAP and subjected to pangenome analysis using PPanGGOLiN software. An open pangenome comprising 901, 7714, 7407 persistent, shell and cloud genes respectively was constructed. Notably, genes associated with antimicrobial compounds were predominantly identified in the shell and cloud partitions, signifying the presence of these compounds in more than one strain. These genes are involved in producing plantaricin C family lantibiotic, lactococcin 972 family bacteriocin, mersacidin/ lichenicidin type II lantibiotic, and gallidermin/nisin family lantibiotic. Among the 189 strains, 10 strains of *Bacillus amyloliquefaciens* have no anti-microbial resistant genes and virulence factors, making them suitable candidates for use in aquaculture.

Phylogenetic tree based on persistent gene set of 189 *Bacillus* strains.

Chromosome-scale genome assembly for Asian seabass

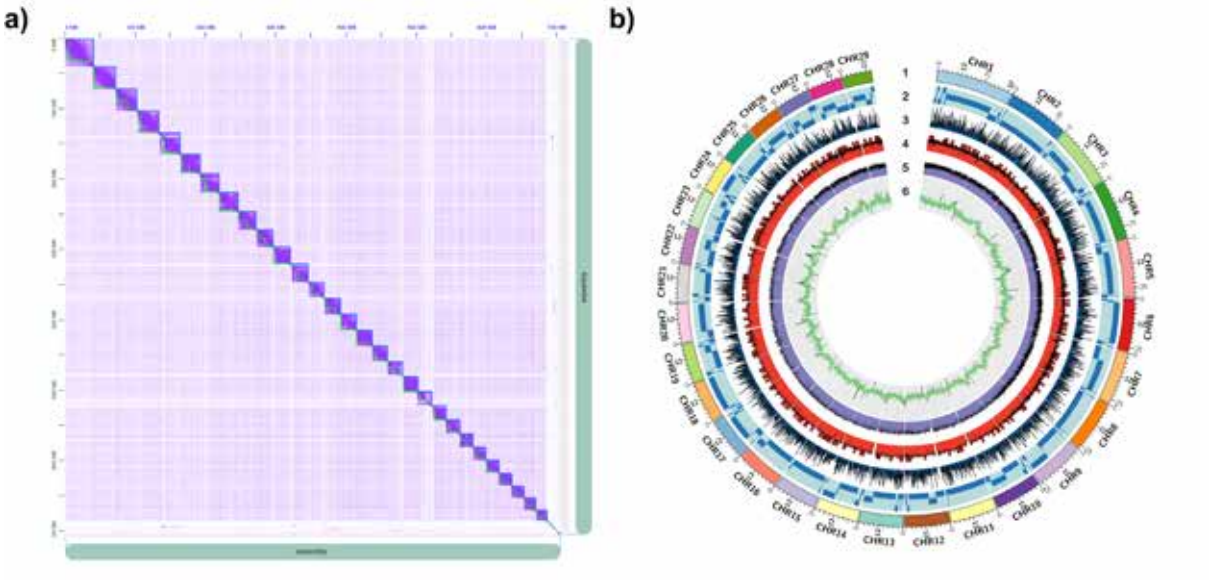
The Asian seabass is an euryhaline, catadromous and protandrous hermaphrodite fish in the Family *Latidae* within the Order *Perciformes*. It is highly valued in aquaculture for the rapid growth, high-quality white flesh, exceptional adaptability, capacity to tolerate crowding, suitability to mono- or polycultures and amenable to culture in wide salinity ranges. A high-quality genome assembly of Asian seabass specimen from Indian sub-continent helps to understand its phylogenetic differences reported with the specimens of South-East Asia and Australia. A chromosome-scale genome assembly has been generated for Asian seabass which has a length of 614.9 Mb in 42 scaffolds with N50 of 26.45 Mb and Quality Value of 68.67. The genome is predicted to contain 19.25 % repeat elements; 30,014 protein encoding genes; and was assessed to be 98.9 % complete. The genome assembly has potential utility to genetic improvement programs and to understand the taxonomic ambiguities.



Depiction of the genome assembly features of Asian seabass. track 1 (outer): chromosome-scale scaffolds; track 2: contigs in chromosome-scale scaffolds shown as tiles; track 3: predicted protein-encoding genes depicted as highlights based on gene lengths; track 4: representation of telomeric repeats at scaffold ends and track 5 (inner): GC content.

Chromosome level genome and full-length transcriptome of long whiskers catfish

Mystus gulio, the long whiskers catfish, belongs to the family *Bagridae* and inhabits brackishwater. The current study employed a multi-platform sequencing strategy including, PacBio HiFi, Illumina short read and chromosome conformation capturing (Hi-C) sequencing technologies to assemble a chromosome level genome. The final assembly is 706.32 Mb with an N50 length of 22.79 Mb with 96.56% of the assembly length anchored to 29 chromosomes. Repeat sequences accounted for 32.66% of the genome and BUSCO analysis revealed a genome completeness of 98.1%. The full-length transcriptomes were also generated for gills, kidney, liver, muscle, ovary, skin, stomach, arborescent organ, dorsal barbel and gallbladder tissues. The transcriptome data was used, to predict 23,339 protein encoding genes, for comprehensive classification of isoforms and for analysis of alternate splicing events. The data has applications to genetic improvement, molecular breeding and evolutionary studies of *M. gulio*.

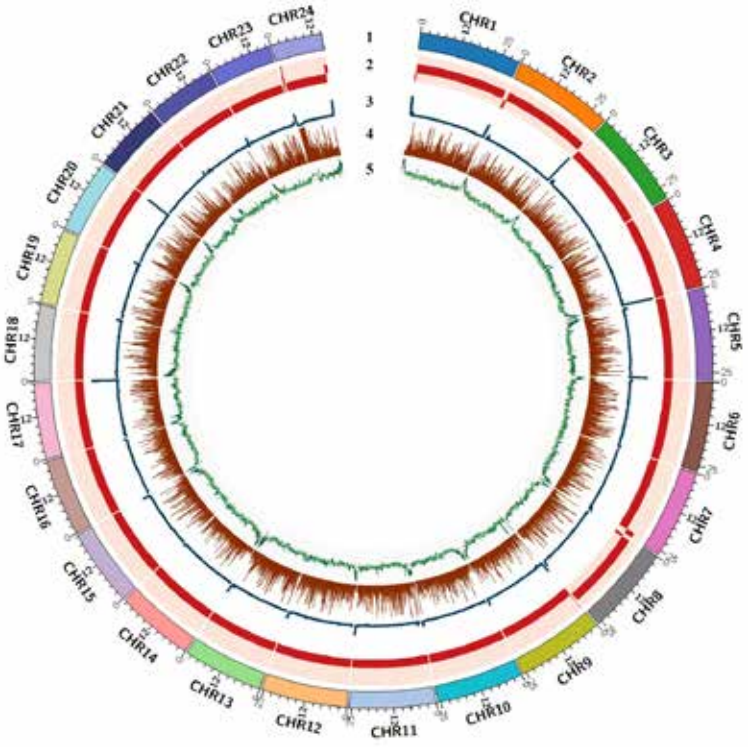


(a) Hi-C contact matrix representing the assembled genome of *M. gulio* in 29 chromosome-level scaffolds.

(b) Circos plot representing various attributes of *M. gulio* genome (From the outermost: track 1: 29 chromosomes, track 2: Contigs corresponding to the 29 chromosomes, track 3: The protein encoding genes, track 4: Full length isoform sequences supporting the genes, track 5: RNAseq derived transcripts supporting the genes, track 6: GC content)

A high-quality, contiguous, chromosome-scale genome assembly for Spinefoot rabbit fish

Earlier, we have generated a genome assembly for rabbit fish, *Siganus javus* which was of chromosome-scale but suffers from low base accuracy (quality value of 32.7) against the reference standard. At present, the low accuracy Pacbio CLR reads have been replaced with High Fidelity (HiFi) reads technology to achieve higher base accuracies in genome assembly. With the help of high-quality HiFi reads, a contiguous, high-quality and chromosome-scale genome assembly has been generated for rabbit fish. The assembly is of 583.1 Mb length in 36 scaffolds with N50 of 25.71 Mb and Quality Value of 67.57. The genome is predicted to contain 18.33 % repeat elements; 29,902 protein encoding genes; and was assessed to be 99.15 % complete. The genome assembly has potential utility to understand the complex biology of the species and in efforts to achieve captive breeding.



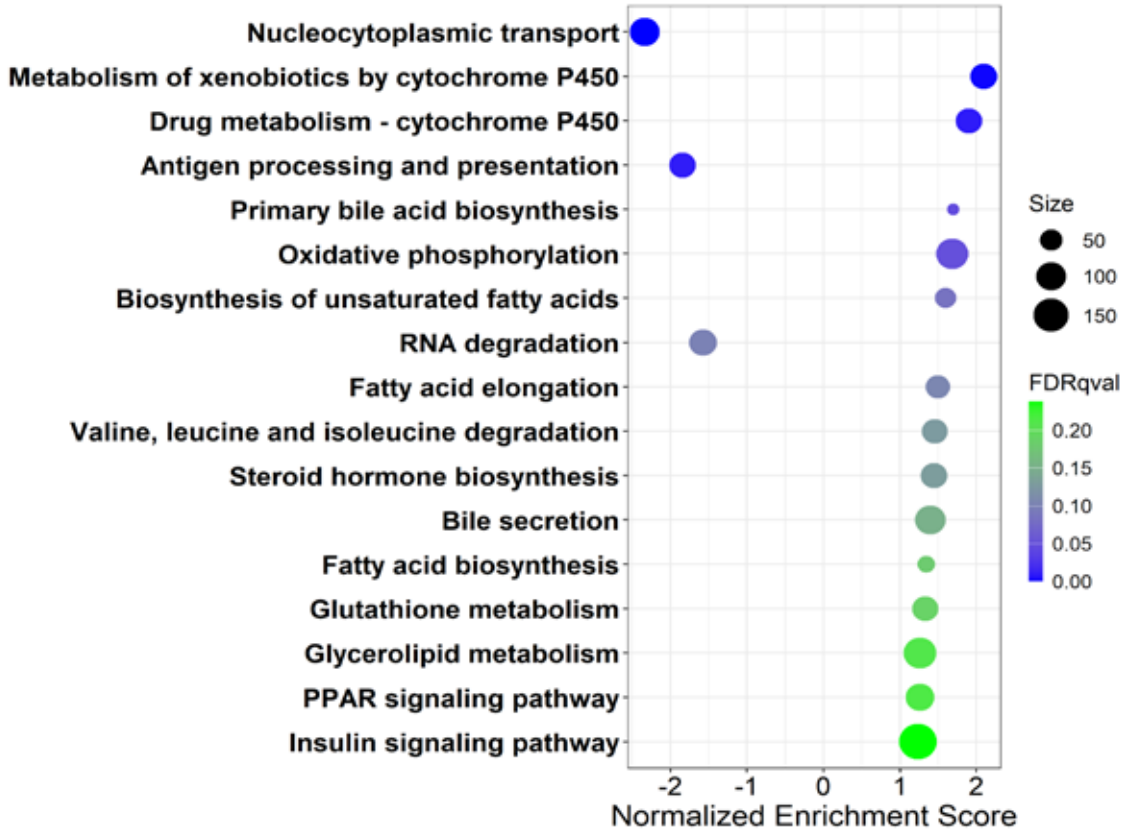
Depiction of the genome assembly features of rabbit fish. track 1 (outer): chromosome-scale scaffolds; track 2: contigs in chromosome-scale scaffolds shown as tiles; track 3: depiction of telomeric repeats at ends of scaffolds; track 4: protein-encoding genes depicted as highlights based on gene lengths; track 5 (inner): GC content.

Mass selection for improved growth performance in Pearlspot

Etroplus suratensis is a commercially important brackishwater food fish, limited by slow growth and seed variability. A selective breeding program was initiated, initially adopting mass selection to reduce operational complexity while aiming for structured pedigree-based breeding as a long-term goal. Culture and feeding were standardized across generations to minimize environmental variation. Larvae were reared for 45 days in indoor FRP tanks, followed by 60 days in hapas, and then in 2×1×1 m meshed cages in open ponds at the rate of 80–100 fish per cage. Growth was recorded as body weight and total length. Selection was based on individuals exceeding the population mean by +2 SD at 240 days post-hatch. The base population comprised 36 selected F1 parents and broodstock from Kottaikadu (94) and Pulicat (126) lakes. Random mating yielded 18 spawns, producing 1,260 fry, of which 450 survived to 240 days. F2 growth showed respectively 12%, 15.2%, and 16.5% superiority at six, eight, and nine months.

Transcriptional changes linked to body weight differences in Pearlspot

Pearlspot fish exhibits high variation in body weight during pond culture. It is important to document the molecular-level transcriptional profiles that vary between low and high body weight fish. In this context, the profiles of different RNA like mRNA, lncRNA and miRNA generated on high and low body weight fish were analyzed and interpreted. Major growth-related pathways like insulin signalling pathway, oxidative phosphorylation, biosynthesis of unsaturated fatty acids, fatty acid elongation, bile secretion, glycerolipid metabolism, PPAR signalling pathway were found positively enriched in liver tissue of heavier fish. Upregulation of rho-class glutathione S-transferase, early growth response protein 1 and adrenodoxin in kidney; troponin I in muscle; and downregulation of IGFBP-4 in liver of heavier fish are few notable transcriptional changes observed to benefit high body weight fish. Further, few non-coding RNA that regulate these important transcripts have been documented.

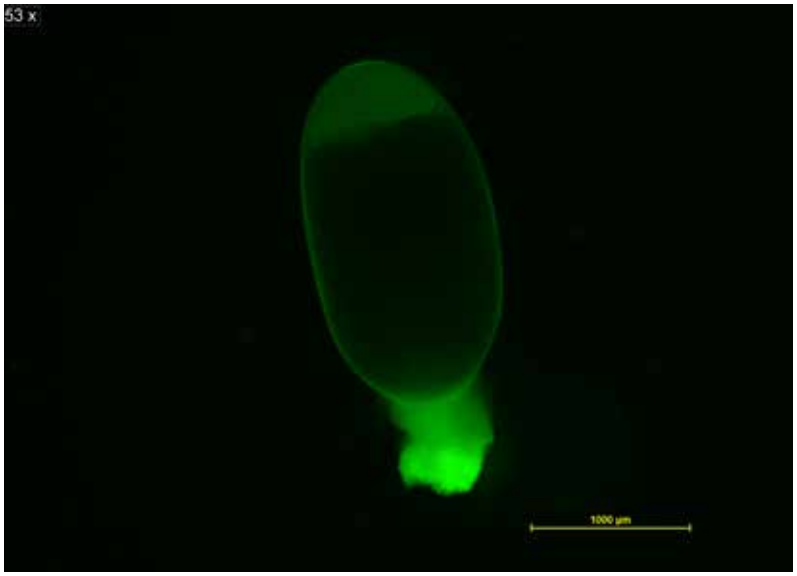


The KEGG pathways enriched in liver tissue of high body weight pearlspot fish compared to low body weight fish

Genome editing of myostatin for growth improvement in brackishwater fishes

Genome editing represents a powerful strategy for improving key production traits in aquaculture species, including growth rate, feed efficiency and fillet yield, thereby contributing to sustainable seafood production to meet rising global demand. The myostatin (mstn) gene is a conserved negative regulator of skeletal muscle development, and its targeted mutagenesis has been shown to enhance myofiber proliferation, muscle mass, and growth performance in several fish species. In this study, single-guide RNAs (sgRNAs) targeting mstn were designed for Asian seabass (*Lates calcarifer*) and Pearlspot (*Etroplus suratensis*), and their cutting efficiency was evaluated using the T7 Endonuclease I (T7E1) assay. CRISPR/Cas9 ribonucleoprotein (RNP) complexes incorporating the validated sgRNAs were delivered into single-cell pearlspot embryos via electroporation, with electroporation parameters optimized using Lucifer Yellow dye uptake as an indicator of successful delivery. Juveniles derived from sgRNA-electroporated pearlspot embryos are currently being reared for genotypic analysis of mstn mutagenesis and phenotypic assessment of growth traits.

a) Pearlspot egg at single-cell stage prior to electroporation



b) Electroporated pearlspot egg labelled with fluorescent dye


CAGE
Kolath

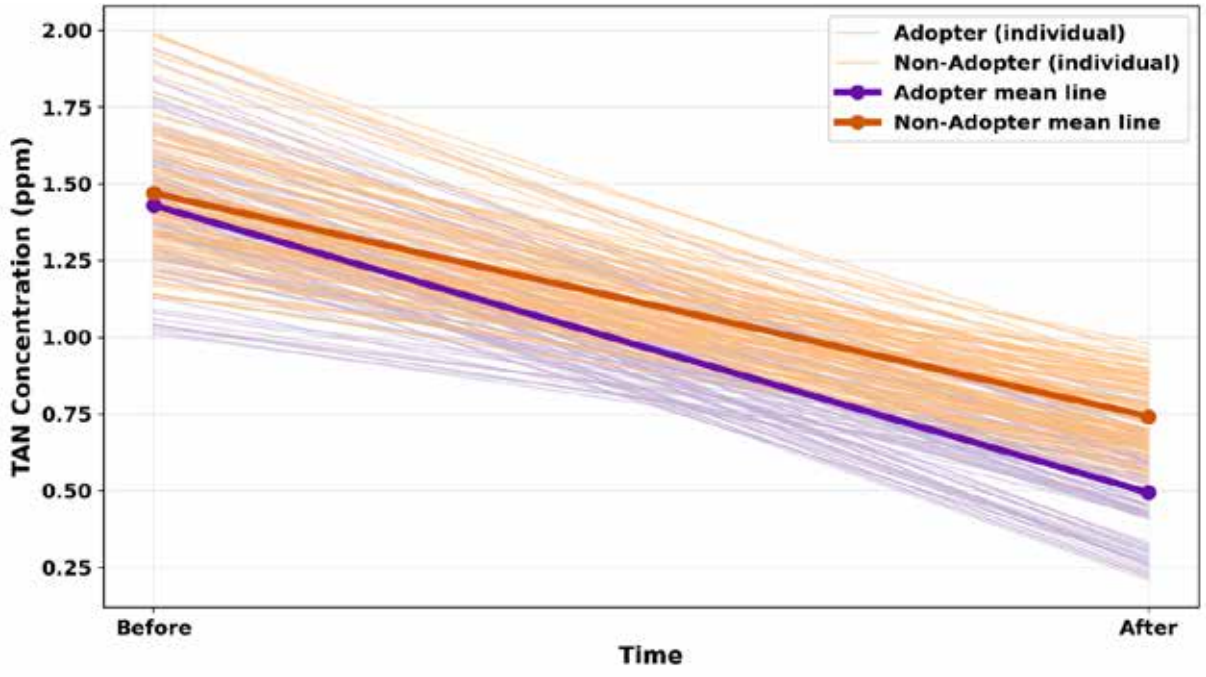
07

Societal linkages and frontline technology demonstrations

Societal linkages and frontline technology demonstrations

Economic impact of water probiotic, CIBAMOX in shrimp farming

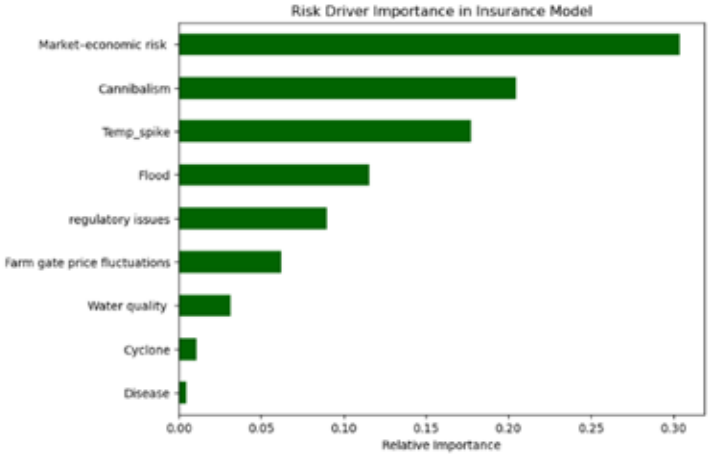
A field-based economic impact assessment of CIBAMOX, a water probiotic technology, was carried out across major shrimp-producing states (n = 205) to quantify its economic and production advantages under farm conditions. Profitability indicators confirmed the economic benefits of technology adoption, with an improved benefit-cost (BC) ratio of 1.22 and a return on investment (RI) of 39.3%. Pond water samples showed a significant reduction in total ammonia nitrogen (TAN), nitrite, and nitrate levels. In addition, the technology also improved biological performance, as indicated by lower feed conversion ratio (FCR), higher survival, and greater biomass harvested. Statistical analyses, including the Shapiro–Wilk test, Wilcoxon signed-rank test, Mann–Whitney U test, and PERMANOVA, confirmed the significant influence of technology adoption on water quality. Furthermore, bootstrap sensitivity analysis demonstrated strong robustness of the treatment effect, while effect size estimates (r ≈ 0.40–0.45) suggested moderate to large practical significance. These results confirm that the observed improvements were both statistically reliable and biologically meaningful.



Impact of CIBAMOX on TAN Reduction (Before vs After)

Risk-based insurance framework for Asian seabass aquaculture

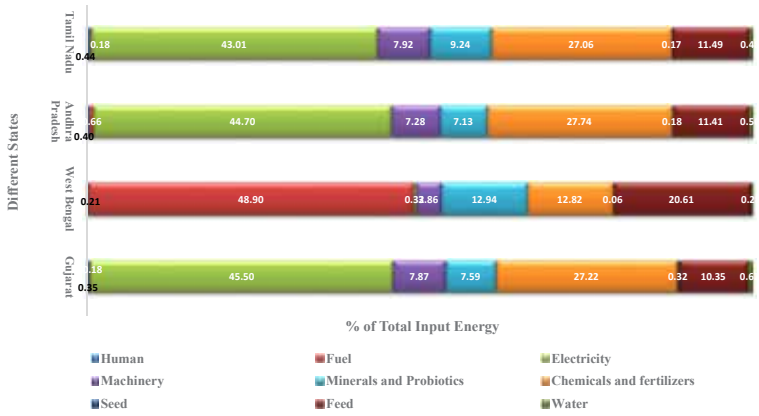
A comprehensive risk assessment and insurance framework was developed for Asian seabass (*Lates calcarifer*) aquaculture using farm-level data from Nagapattinam, Mayiladuthurai, Thiruvarur, Thanjavur, and Cuddalore districts. The study identified key biological, environmental, operational, and economic risks affecting production and insurability. Cannibalism-related mortality (20–30%) and disease outbreaks under heat and crowding stress were major biological risks, while cyclones, floods, salinity fluctuations, and low dissolved oxygen were the principal environmental threats. High feed costs (₹100–110 kg^{-1}; FCR 1.5–2.4) and market volatility further increased farmer vulnerability. Nine critical risk factors were used to classify farms into low, medium, and high-risk categories, corresponding to actuarially fair premium rates of 3%, 5%, and 7%, respectively. A Random Forest model predicted farm risk levels with 90% accuracy, identifying biological and economic risks as the primary drivers. Although awareness of aquaculture insurance was low and species-specific products were absent, farmers showed strong interest in affordable, transparent insurance linked to Better Management Practices (BMPs).



Major risk drivers in Asian seabass farming identified using the Random Forest model

State-wise energy use indicators in shrimp production

Energy budgeting in white-leg shrimp (*Penaeus vannamei*) farming is crucial because of rising production costs, high energy consumption, and growing environmental concerns.
Based on data from 120 farms across major shrimp-producing states in India, this study found that the mean total input energy was highest in Gujarat (593.48 MJ kg^{-1}), followed by Tamil Nadu (589.73 MJ kg^{-1}) and Andhra Pradesh (576.16 MJ kg^{-1}). West Bengal recorded the lowest energy use, at 446.52 MJ kg^{-1}. Energy efficiency was low across all states (3.16–4.21%), with West Bengal showing the highest efficiency. Net energy was negative in all cases, indicating that energy inputs exceeded energy outputs. Energy productivity was also low, although it was relatively higher in West Bengal. Intensive farming systems had lower specific energy requirements, while high overall energy use was primarily driven by aeration and feed inputs. These findings highlight the need to optimize energy use and promote the adoption of renewable energy sources in shrimp farming.



State-wise distribution of energy input components in *Penaeus vannamei* production

Socio-economics, gender, and environmental challenges of coastal communities in Tamil Nadu

This study assessed the socio-economic status of coastal households, analyzed women's participation in aquaculture sectors, and examined environmental impacts on coastal livelihoods. The key challenges faced by communities were identified, and explored the gender role in income generation and resource use with special focus on participation in fish farming, ornamental fish farming, fish meal preparation, different crab farming models, and crab markets. The survey was conducted in selected coastal villages of Senjiamman, Kulathur, Pulicat, Karnodai, and Arambakkam in Tiruvallur and the Chidambaram area of Cuddalore District, Tamil Nadu. Most respondents were aged 40–60 years and belonged to the Scheduled Caste and the Scheduled Tribe communities. Many coastal women were illiterate, followed by primary-level education, which helped them understand techniques and adopt training and demonstrations. Most respondentsare facing issues like sea erosion, ban on fishing in Pulicat lake and the evacuation of the village due to rocket launching at Sriharikota.

Ornamental fish farming at Kulathur, Athur and Karanodai villages

Crab market – Arambakkam

Demonstration of high-density whiteleg shrimp farming at Navsari, Gujarat

High-density farming of whiteleg shrimp, *P. vannamei*, was demonstrated to SC communities in Navsari. Additionally, nursery rearing of shrimp PL to obtain juvenile shrimp that are more suitable for stocking to high density rearing systems was also demonstrated. Two trials were conducted in small sized HDPE lined ponds of an area ranging from 700-1000 m^{-2}. In the first crop, shrimp were stocked at two densities viz., 94 and 104 nos./m^2, and resulted in a production of 913.50 Kg and 898.22 Kg, respectively in a period of 56 days and a total revenue of ₹6,07,121 was generated. The shrimp attained an average body weight of 11.25 and 9.94 grams, respectively. In the second crop, shrimp were stocked at higher densities of 117 and 134 nos./m^2, and resulted in the production of 1562 Kg and 1525 Kg and productivity of 19-22 tonnes/ha/crop, respectively at the end of 92 days. A total revenue of ₹8,12,111 was obtained through the sale of shrimp. The demonstration helped in the training and adoption of improved farming technologies for livelihood enhancement.

Harvest from high-density shrimp farming

Field validation of seaweed-integrated shrimp farming (SISF) model in commercial ponds

A field demonstration of the seaweed–shrimp integrated farming model was conducted at the MoU partner farm, Uday Aquaconnect Private Ltd., Mulapolam, Srikakulam District, Andhra Pradesh, to evaluate its feasibility under commercial conditions. Shrimp (*Penaeus vannamei*, PL-9) were stocked at 60,000 per 1000 m^2 pond and reared for 93 days in integration with *Gracilaria salicornia* cultivated in tube nets. Harvest yields ranged from 1.50 to 1.54 tonnes per pond, with a mean final body weight of 24.19-27.03 g and an FCR of 1.33-1.37. Seaweed stocked at 180 kg doubled its biomass within 50 days. These results confirmed the operational compatibility of seaweed integration, demonstrating stable shrimp growth, efficient feed utilization, and additional biomass production, thereby supporting enhanced productivity and sustainability in commercial coastal aquaculture systems.

Harvest of shrimp from seaweed-shrimp integrated farm

Innovative seed-to-harvest approach for sustainable blue swimmer crab production

Demonstration of blue swimmer crab (*Portunus reticulatus*) farming was conducted under the SCSP scheme to empower a successful Self Help Group (SHG) comprising 15 members from five families. Hatchery-produced seeds supplied by ICAR-CIBA, with an average initial weight of 5 g, were stocked at a density of 0.2 nos. m^{-2} in two earthen ponds covering a total area of 600 m^2. Crabs were reared for 90 days and fed a formulated CIBA pellet diet supplemented with low-value fish. At harvest, the crabs attained a mean body weight of 140–170 g, with survival exceeding 75%. A total biomass of 25 kg was produced. Quality grading indicated that 75% of the harvested stock fell under Grade 4, 15% under Grade 3, and 10% under Grade 2, demonstrating satisfactory market quality. The produce realized a farm-gate price of ₹. 500–600 per kg, generating a total revenue of ₹. 13,500. Top of Form

Stocking of Blue swimmer crab in earthen pond

Harvest of Blue swimmer crab from earthen pond

Demonstration of integrated mud crab–shrimp polyculture at Tamil Nadu

Polyculture of mud crab (*Scylla serrata*) and shrimp (*Penaeus vannamei*) was undertaken in a 2,500 m² earthen pond under the SCSP scheme at Muttukadu Experimental station of ICAR-CIBA with Pattipulam farmers, Chengalpattu district, Tamil Nadu, to evaluate production and economic performance. Juvenile mud crabs (50 g) were stocked at 0.1 nos. m^{-2} and fed low-value trash fish, while shrimp post-larvae were stocked at 10 nos. m^{-2} and fed CIBA-formulated pellet feed. After 75 days, mud crabs reached 350–700 g, yielding 40 kg and generating ₹30,500. Shrimp production from the same pond was 105 kg (16–21 g size), sold at ₹300 per kg, generating ₹31,500 and benefiting five families. The results demonstrate the technical feasibility and economic viability of integrated mud crab–shrimp polyculture in brackishwater pond systems.

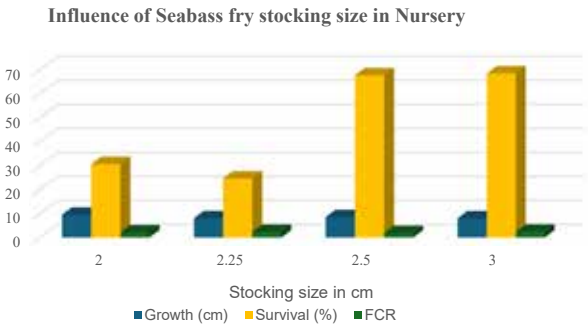
Harvested mud crab and shrimp

Diversified finfish farming by coastal communities in Balasore District, Odisha

Under the institute's TSP program, demonstrations on diversified brackishwater finfish polyculture, nursery rearing, and backyard hatchery technology were conducted at the beneficiary farm in Balasore district, Odisha. A total of 35,000 milkfish seeds were initially reared in nursery ponds, and fingerlings (10–15 g) were stocked in 22 earthen ponds (0.4–0.5 ha each). After 240 days of culture, milkfish attained sizes of 300–800 g and productivity of 1.8–2.0 t/ha. Harvesting of fish above 700 g body weight fetched farm-gate prices ranging from ₹200–220/kg in local and Howrah markets. The demonstration served as a model for improving aquaculture productivity and livelihood opportunities among tribal and coastal farming communities.

Seabass nursery rearing demonstration for livelihood development of the coastal communities in Tamil Nadu

Four nursery-rearing cycles of Asian seabass were conducted in Mayiladuthurai district of Tamil Nadu over 60–70 days using fry of four initial sizes (2.0, 2.25, 2.5, and 3.0 cm), each in triplicate. After 12 grading events, survival rates ranged from 30.68–34.63% for smaller fry and 67.55–68.32% for larger fry, while average growth reached 8.0–8.5 cm across treatments. Feed conversion ratio (FCR) was higher in smaller fry (2.4) than in larger fry (1.8), indicating lower feed-use efficiency. Stocking fry of 2.5 cm and above significantly improved survival, growth, and feed utilization ($p \leq 0.05$), whereas moderate variations in temperature and salinity had no significant effect. The study highlighted the importance of an intermediate pre-nursery phase to raise fry from 1.0 to 3.0 cm using specialized feed, thereby enhancing production efficiency. The intervention also created livelihood opportunities for Scheduled Caste communities, generating about 150 person-days of employment for 20 families and producing revenue of ₹3.68 lakh through fingerling sales.



Influence of stocking size of Asian seabass fry in growth during nursery phase

Grading and feeding of seabass of fish fry in the nursery

Demonstration of three-tier seabass farming for development of aquaculture-based livelihood systems in Tamil Nadu

Under a societal development programme, aquaculture-based livelihood interventions were implemented for the socio-economic upliftment of coastal Scheduled Caste communities in Kovalam (Kanchipuram district) and Mathampattinam (Mayiladuthurai district), Tamil Nadu. A total of 150 beneficiaries were selected and trained in Asian seabass nursery rearing using hapa systems and three-tier farming through targeted skill development programmes. Approximately 40,000 seabass seeds, along with essential inputs such as feed and hapa nets, were supplied for fingerling production. At Kovalam, 16,000 fingerlings (3–4 inches) were produced and sold to grow-out farmers, generating revenue of ₹6.64 lakh. At Mathampattinam, 21,000 fingerlings were produced, yielding ₹8.2 lakh. To further strengthen livelihood opportunities, a small-scale seabass hatchery with an annual production capacity of one million seeds is being established at ICAR-CIBA, Kovalam. The hatchery is being operated by Scheduled Caste youth with technical support from ICAR-CIBA. The programme enhanced technical skills, self-reliance, and income generation, promoting sustainable aquaculture-based livelihoods in coastal communities.

Training program on seabass nursery rearing

Demonstration of Asian seabass farming in HDPE modular cages in Tamil Nadu

Under the Scheduled Caste Sub Plan (SCSP), HDPE cage farming systems were established at Kolathur and Kottaikadu in Chengalpattu district, Tamil Nadu, to enhance livelihood opportunities for coastal fisher communities. Each modular, non-corrosive HDPE unit comprised five cages (6 × 4 × 2.5 m), a feed storage shed, solar lighting, safety railings, and CCTV surveillance. Baseline assessments revealed that beneficiary households belonged to the medium-income group with limited access to aquaculture infrastructure and investment resources. To address these constraints, six cages were stocked with Asian seabass fingerlings at a density of 20 fish/m³ (1,250 fish per cage), totalling 7,500 fingerlings. Fish were fed CIBA SEABASS^{PLUS} feed twice daily according to biomass. From an initial weight of 12.5 g, seabass at Kolathur attained 700 g after eight months, while those at Kottaikadu reached 275 g after three months. Regular net cleaning, biomass estimation, and health monitoring were undertaken. The intervention created durable aquaculture assets and established a sustainable livelihood model for resource-poor coastal communities.

HDPE modular cage unit installed under the SCSP programme at Kolathur village

Demonstration of pond-based cage culture of Asian seabass in Navsari, Gujarat

Pond-based cage culture was demonstrated as a livelihood activity for SC communities in Matwad, Navsari. The beneficiaries were earlier trained on nursery rearing of seabass. The advanced juveniles (250 nos.) of body weight 50-100 g obtained from the nursery and pre-grow out operations were stocked into 5.0 m x 2.0 m x 2.0 m rectangular 30-40 mm mesh HDPE cages at a stocking density of 25 nos./m³ during February and reared for a period of 300 days. The fish were fed a formulated seabass diet at 2-5% of their body weight, with feeding rates adjusted according to survival and growth. The cage nets were changed every 15-20 days to prevent clogging and to enable sufficient water flow through the cages. At the end of 300 days, 132 kg of seabass was harvested with an average body weight of 729.28 g and a survival rate of 72.4%, resulting in a productivity of 13.2 kg/m³. The SC group realised a revenue of ₹ 28,940 through the sale of Asian seabass.

Harvest of Asian seabass from pond-based cages

Pond-based cage culture of pearlspot as a livelihood activity in Navsari, Gujarat

Cage culture of pearlspot (*Etroplus suratensis)* was demonstrated at Matwad village in Navsari as a livelihood activity for coastal SC communities. Size-sorted pearlspot juveniles (40-100 g) were stocked into 5.0 m x 2.0 m x 2.0 m HDPE floating cages (30 mm mesh) for grow-out rearing and production of broodstock for seed production. Around 600 brood fish of 175-300 g were supplied to the pearlspot hatchery at NGRC of CIBA for seed production at the end of the grow-out trial. Additionally, the self-help group sold 106 kg of table sized pearlspot fish locally and obtained a revenue of ₹ 37,100.


Harvested pearlspot from pond-based cages

Demonstration of the potential use of plankton *plus* in reducing feed requirement in low saline carp culture

A field demonstration trial was conducted at Patibunia village in Namkhana Block, South 24 Parganas, West Bengal, to assess the potential of CIBA-Plankton^{Plus} (PP) in reducing the dependence on formulated feed in carp culture under low-salinity conditions. The 180-day study was carried out in 18 homestead ponds across the Sundarbans, involving 36 Scheduled Tribe farmers. Seven treatment combinations were tested, integrating different levels of formulated feed (100%, 80%, and 60%) with two PP application rates (20 ppm and 40 ppm). Catla (*Catla catla*) and Rohu (*Labeo rohita*) were stocked at a density of 1 fish/m² in a 1:1 ratio. The trial evaluated the effects of reduced feed input and PP supplementation on water quality, plankton abundance, and fish growth. Results indicated that PP applied at 40 ppm significantly enhanced plankton density and overall pond productivity, which in turn improved the growth performance of both Catla and Rohu, even with a 20% reduction in formulated feed. This approach also resulted in improved economic returns for the participating farmers.

Harvesting of Indian Major Carps (IMC) from the low saline cultured pond of tribal farmers

Field validation of Plankton^{Plus} for enhancing maize and potato production in West Bengal

A field experiment was conducted over 75 days using a factorial randomized block design (RBD) to evaluate the effectiveness of Plankton^{Plus} (PP) in maize and potato cultivation. The study included eight treatment combinations with three replications, covering 24 plots (5 m × 3 m each). Four PP concentrations (0, 5, 6, and 7%) were tested under two fertilizer regimes: 100% recommended dose of fertilizers (RDF; 150:100:100, N:P_2O_5:K_2O) and 75% RDF. In maize, PP application improved yield under both fertilizer levels, with the highest yield (~12.8 t ha^{-1}) recorded at 5% PP combined with 100% RDF. Compared to the control (100% RDF without PP), yield increased by 27% under 5% PP + 100% RDF and by 8% under 5% PP + 75% RDF. In potato, foliar application of PP enhanced tuber yield across both fertilizer levels, with the maximum yield observed at 6% PP. Notably, the combination of 6% PP with 75% RDF resulted in a 13.8% increase in yield over the control, demonstrating that inorganic fertilizer use can be reduced by up to 25% without compromising productivity.

Effect of Plankton^{plus} on maize (a) and Potato (b) yield


CRAX

Human Resource Development (HRD) Training, Capacity Building, and Skill Development

Training Programmes attended

Scientists

Sl.No	Name and designation	Programme	Venue	Duration	Organized by
1	Dr. R. Ananda Raja Principal Scientist	Aquatic Animal Epidemiology	Chennai	29 Sept. - 3 Oct. 2025	NSPAAD
2	Dr. T. Bhuvaneswari Senior Scientist				

Administrative Staffs

Sl.No	Name and designation	Programme	Venue	Duration	Organized by
1	Shri Kushal Assistant	Orientation Training Programme for DR Assistant (Module I)	Bengaluru	3-7 March 2025	ICAR –IIHR
2	Shri Anand Assistant				
3	Shri Vishal Dattatray Hinge Assistant				
4	Ms. Jayasri Assistant				
5	Shri Pradeep Biradar Assistant				
6	Shri Karthick Assistant				
7	Ms. Sambavi J. Assistant				

Training Programmes Conducted

Sl. No.	Training Programmes	Duration	No. of participants
1.	Aquaculture Pond water and soil analytical techniques and interpretation of results	7-9 January 2025	15
2.	Awareness-cum-training camp on "Nursery rearing of Asian seabass fish as livelihood development and employment generation intervention for the Scheduled Caste families in the coastal villages of Mayiladuthurai district at Poompuhar College, Poompuhar	25 February 2025	150
3.	Entrepreneurship development in aquatic animal health management	3-8 March 2025	30
4.	Entrepreneurship opportunities in aquaculture for Gujarat	3-8 March 2025	26
5.	Awareness program on brackishwater technologies	3 March 2025	50
6.	Awareness program on brackishwater technologies in finfish seed production	6 March 2025	50
7.	Awareness program on brackishwater technologies	7 March 2025	50
8.	Mud crab seed production and farming	10-15 March 2025	25
9.	Awareness program on brackishwater technologies in finfish seed production	10 March 2025	50
10.	Awareness program on brackishwater technologies in shellfish seed production	11 March 2025	50
11.	Awareness program on brackishwater technologies in feed management	12 March 2025	50
12.	Awareness program on brackishwater technologies in feed management	13 March 2025	50
13.	Entrepreneurship opportunities in Brackishwater fish seed production and farming	17-21 March 2025	35
14.	Brackishwater aquaculture technologies for entrepreneurship development in Sundarbans	17-22 March 2025	25
15.	Skill Development and Training Program for live feed production and management in brackish-water aquaculture	17-22 March 2025	25
16.	Awareness program on health management in aquaculture	18 March 2025	50
17.	Awareness cum training programme on hatchery seed production of Asian seabass to empower coastal scheduled caste beneficiaries of coastal village in Tamil Nadu	20 March 2025	80
18.	In-house training programme in Brackishwater aquaculture	18 April -2 May 2025	14
19.	Hands-on training programme on NGS Data analysis	19-23 May 2025	20
20.	Nutrition feed technology and health management in aquaculture	21-27 May 2025	11
21.	Nutrition and feed technology and disease management in brackishwater aquaculture	1-7 June 2025	15
22.	Advanced aquaculture practice for resilient and sustainable development in Odisha	23-27 June 2025	20

Sl. No.	Training Programmes	Duration	No. of participants
23.	Hands-on training to initiate seaweed integration with shrimp culture in an earthen pond	27 June 2025	2
24.	Roster and Reservation in Government Services	24-25 July 2025	32
25.	Hands-on training programme on Asian Seabass (*Lates calcarifer*) fingerling seed production for scheduled caste beneficiaries of Kovalam village, Chengalpattu District, Tamil Nadu	29 July 2025	40
26.	Advanced aquaculture practice for resilient and sustainable development in Odisha	4-8 August 2025	23
27.	Hands on training on Asian seabass fingerling production for the SC beneficiaries of Mathampattinam village, Mayiladuthurai district, Tamil Nadu	7 August 2025	50
28.	NFDB sponsored Farmer's awareness and capacity building programme on Shrimp disease management at Vellankanni, Nagapatinam	10 August 2025	130
29.	Farmer's awareness programme on "AMR awareness in aquaculture and mitigation strategies"	26 August 2025	90
30.	Advances and innovations in brackishwater finfish hatchery production and farming system	8-12 September 2025	14
31.	School on Aquatic Animal Epidemiology	29 Sept. -3 Oct. 2025	20
32.	Advanced aquaculture practice for resilient and sustainable development in Odisha	13-17 October 2025	25
33.	Mud crab farming: A practical hatch-to-harvest training	17-21 November 2025	22
34.	Advanced aquaculture practice for resilient and sustainable development in Odisha	24-28 November 2025	25
35.	Advanced aquaculture practice for resilient and sustainable development in Odisha	8-12 December 2025	25
36.	An outreach activity on shrimp disease management at Amalapuram, Andhra Pradesh	19 December 2025	110
37.	Rashtriya Karmayogi Training Programme	22 December 2025	35
38.	Rashtriya Karmayogi Training Programme	23 December 2025	35

Training on brackishwater technologies in finfish seed production at Kakdwip Research Centre

Hands-on training programme on Asian seabass fingerling seed production for scheduled caste beneficiaries of Kovalam village, Chengalpattu District, Tamil Nadu

In- house training programme as part of student READY programme at Kakdwip Research Centre

A school on Aquatic Animal Epidemiology

Ph.D. Awarded

Dr. Nishan Raja R

Thesis Title :

Brackishwater seaweed distribution and its farming potential assessment using geospatial techniques in Chengalpattu District, Tamil Nadu, India

Supervisor :

Dr. P. Nila Rekha

Principal Scientist

Dr. K. Nimisha

Thesis Title :

Mining genomic resources and map functional pathways significant for WSSV infection in shrimp through in silico approach

Supervisor :

Dr.Vinaya Kumar Katneni

Principal Scientist

Dr. M. Samynathan

Thesis Title :

Geospatial planning for sustainable use of coastal resources with reference to aquaculture in Ramanathapuram District, Tamil Nadu

Supervisor :

Dr. M. Jayanthi

Principal Scientist

Dr. Rashmi Ranjan Das

Thesis Title :

Assessment of reproductive performance in different stocks of Indian white shrimp, Penaeus indicus across Indian coast and establishment of its immunological and growth potential

Supervisor :

Dr. Akshaya Panigrahi

Principal Scientist

Workshops, Seminars and Meetings

Conducted 4th Edition of Shrimp Farmers Conclave in Balasore, Odisha

The fourth edition of the 'Shrimp Farmers Conclave' was organized by ICAR-CIBA and the Department of Fisheries, Government of Odisha, at Balasore on 31 January 2025. The event brought together over 500 farmers and stakeholders from coastal Odisha to discuss species diversification, disease management, next-generation production systems, and crop insurance. The conclave facilitated farmer-to-farmer learning, networking, and technology dissemination through expert sessions, success-story sharing, and an exhibition of aquaculture inputs and ICAR-CIBA technologies.

Dr. J. K. Jena, Deputy Director General-Fisheries, ICAR, Dr Kuldeep K. Lal, Director, ICAR-CIBA, and Dr. P. K. Sahoo, Director, ICAR-CIFA participated in the program, which was coordinated by Dr. A. Panigrahi, Principal Scientist, ICAR-CIBA.

Organized Seafood Festival at Dandi, Surat

A Seafood Festival was organized at Dandi Beach, Surat, from 21–23 February 2025 by ICAR-CIBA and SAFPO, with support from the Department of Fisheries, Government of Gujarat, and the NFDB. The event promoted domestic fish consumption and showcased seafood delicacies from across India. Over 45 seafood outlets participated, including the ICAR-CIBA-supported tribal self-help group 'Halpati Samaj Matsya Mandal' from Navsari. The festival attracted around 20,000 visitors, highlighting the vast potential for expanding domestic seafood consumption. Shri. Mukesh Zinabhai Patel, Honourable Minister of Forest and Environment, Climate Change, Water Resources and Water Supply, Govt. of Gujarat, inaugurated the seafood festival in the presence of Dr. Kuldeep K. Lal, Director, ICAR-CIBA, Sh. Puneet Issar, a popular Bollywood actor and Shri. Pradeep Navik, President, SAFPO.

Celebrated World Intellectual Property Day with the Theme "IP and Music: Feel The Beat of IP"

World Intellectual Property Day was celebrated on 1st May 2025 to create awareness among young inventors, researchers, entrepreneurs, academicians, and students about intellectual property rights and innovation. Ms. Scarlet Danielle Grey, Senior Associate, M/s Anand and Anand, Chennai, delivered a lecture on WIPO, patents, trademarks, and copyrights. The programme included an interactive session on IP-related issues with scientists, technical staff, and students from ICAR-CIBA and its regional centres.

Organised Expert consultation on Aquaculture Medicines: Research, policy and implementation

A national consultation on "Aquaculture Medicines: Research, Policy and Implementation" was held on 8–9 May 2025 at the NASC Complex, ICAR, New Delhi. The programme deliberated on the findings of the ICAR-funded All India Network Project on Fish Health (AINP-FH) and develop regulatory guidelines for aquaculture medicines. Experts from ICAR, the Department of Fisheries, MPEDA, CDSCO, EIC, and partner institutions discussed approved therapeutics, data gaps, and policy requirements, culminating in recommendations for evidence-based regulation of aquaculture medicines in India. Dr. J. K. Jena, DDG (FS), ICAR, Shri. Sagar Mehra, Joint Secretary, Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India, Dr. P. K. Sahoo, Director, ICAR-CIFA, Mr. P. Anil Kumar, Joint Director, MPEDA, Dr. Gouri Shankar, Deputy Drug Controller, CDSCO, Govt. of India, Mr. Palani Kumar, Assistant Director, Export Inspection Council (EIC), Govt. of India, Dr. Kuldeep K. Lal, Director, ICAR-CIBA, and Dr. P. K. Patil, Project Coordinator, ICAR-CIBA, Chennai participated in the workshop.

Celebrated World Environment Day-2025

World Environment Day was celebrated on 5th June 2025 with the theme 'Beat Plastic Pollution'. Dr. P. Shanmugam, Chief Scientist (G), CSIR-Central Leather Research Institute, Chennai delivered a motivational speech on the individual's role in the society for abatement of plastic pollution. He emphasised on the rules and regulations implemented to overcome the plastic use and the practices to be adopted to reduce the plastic pollution in different ecosystems. Dr. C. P. Balasubramanian, HoD, CCD and Director in-charge presided over the event, and Dr. M. Muralidhar, Principal Scientist, AAHED, ICAR-CIBA coordinated the programme.

Celebrated International Yoga Day

International Yoga Day was celebrated on 21 June 2025. A yoga practice session was conducted under the supervision of Dr. Janani Subburaj, Specialist in Yoga & Naturopathy. Dr. Kuldeep K. Lal, Director, ICAR-CIBA and the staff actively participated via both physical and online mode from the Headquarters and regional centres.

ICAR - CIBA celebrated National Fish Farmers Day 2025

National Fish Farmers Day was celebrated on 10th July 2025 across ICAR-CIBA and its regional centres under the leadership of Dr. Kuldeep K. Lal, Director, ICAR-CIBA, engaging about 186 fish farmers and fishers from Tamil Nadu, West Bengal, and Gujarat. The programme highlighted brackishwater aquaculture technologies, including seabass nursery rearing, cage farming, IMTA, ornamental fish culture, feed, soil and water quality parameters, integrated fish and seaweed culture, and Plankton^{Plus} technology. Farmers shared success stories and received technical guidance, while a live stream of the national celebration organized by ICAR-CIFA, Bhubaneswar, further enhanced outreach and awareness.

Organised the farmer–scientist interaction meet as part of the PM-KISAN event

ICAR-CIBA organized special farmer–scientist interaction programmes at Chennai, Kakdwip, and Navsari to mark the release of the 20th instalment of the PM-KISAN scheme. Dr. Kuldeep K. Lal, Director, ICAR-CIBA provided insights into the scheme's benefits, and beneficiaries shared their success stories. The events facilitated direct engagement between farmers and scientists, creating awareness about government initiatives and aquaculture technologies. At Chennai and MES, 125 participants attended sessions on seabass seed production, feed formulation, and farming technologies, while beneficiaries shared their experiences and expectations from ICAR-CIBA.

Conducted an outreach activity on disease management at Velankanni, Tamil Nadu

ICAR-CIBA, in collaboration with the Prawn Farmers Federation of India (PFFI), launched a novel joint problem-solving initiative to address shrimp diseases, particularly White Faeces Syndrome (WFS) and the emerging "running mortality" disease. The programme promotes collaborative research involving scientists and farmer groups to identify causes and develop management strategies. About 130 farmers participated in the programme. Dr. Kuldeep K. Lal, Director, ICAR-CIBA, and Mr. Balasubramaniam, General Secretary, PFFI, briefed the farmers about the project activities and highlighted the involvement of other government agencies and private partners.

Conducted Antimicrobial Resistance Awareness for aqua farmers at Nagapattinam

An awareness programme on Antimicrobial Resistance (AMR) was conducted at the Krishi Vigyan Kendra of Tamil Nadu J. Jayalalitha Fisheries University (TNJFU), Nagapattinam under the ICAR-funded All India Network Project on AMR. More than 90 aquaculture farmers participated in the programme. ICAR-CIBA scientists highlighted the risks and future consequences of AMR, emphasized responsible antimicrobial use, and provided guidance on health management and sustainable aquaculture practices through interactive discussions.

Organised the 12th edition of International Symposium on Diseases in Asian Aquaculture (DAA'12), in Chennai

ICAR-CIBA, in association with the NFDB and the Fish Health Section of the Asian Fisheries Society, organized the 12th International Symposium on Diseases in Asian Aquaculture (DAA'12) during 23–27 September 2025 in Chennai. The event, themed "Transformative Innovations Shaping the Future of Aquatic Animal Health Management," brought together 436 participants, including 71 international delegates from 21 countries. The symposium featured 257 presentations across eight technical sessions. Shri. George Kurian, Honourable Union Minister of State for Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying

and Minority Affairs, Government of India virtually inaugurated the international convention in the presence of Dr. J. K. Jena, Deputy Director General (Fy.), ICAR, New Delhi, Dr. N. Subbaiyan, Secretary, Dept. of Animal Husbandry, Dairying, Fisheries & FW, Govt. of Tamil Nadu, Dr. Kua Beng Chu, Chairperson, Asian Fisheries Society (FSH), Dr. B. K. Behera, Chief Executive, NFDB and Dr. Kuldeep K. Lal, Director, ICAR-CIBA & Convener, DAA'12. Dr. Tarun Shridhar, the former Secretary, Department of Fisheries, Govt. of India was the chief guest during the valedictory session. The symposium was concluded with the 5th Shrimp Farmers Conclave on 27th September 2025, as the final event of the international convention, wherein more than 50 farmers, stakeholders and other participants of the symposium promoting stakeholder engagement and disease management awareness. Shri. K. C. Devasenapathy, IAS, Secretary of the Coastal Aquaculture Authority, Govt. of India, attended as the Chief Guest and interacted with the participants.

Conducted a Shrimp-Farmers Conclave at Churu, Rajasthan

The 6th Shrimp Farmers Conclave (SFC) of ICAR-CIBA was held on 1st November 2025 at Churu, Rajasthan, to facilitate direct interaction with farmers and address region-specific challenges in inland saline shrimp farming. The event brought together over 200 participants, including farmers, scientists, policymakers, and government officials. The conclave, a first of its kind in the region, highlighted the growing importance of inland shrimp aquaculture in north-western India and provided a platform to discuss technological, policy, and extension support for sustainable sectoral growth. Shri. Rahul Kaswan, Hon'ble Member of Parliament (Lok Sabha) and Dr. Mangi Lal Jat, Secretary, Department of Agricultural Research and Education (DARE) and Director General, Indian Council of Agricultural Research (ICAR) were the esteemed chairs of this program. Dr J. K. Jena, Deputy Director General (Fisheries), ICAR and Dr. Rajbir Singh, Deputy Director General (Agrl. Extension), ICAR, Dr.B.K. Behera, the Chief Executive, National Fisheries Development Board, Dr. N. P. Sahoo, Director, ICAR-CIFE and Dr. Kuldeep K. Lal, Director, ICAR-CIBA graced the event.

Observed Vigilance Awareness Week 2025

ICAR-CIBA observed Vigilance Awareness Week 2025 from 27th October to 2nd November 2025 under the theme "Vigilance – Shared Responsibility of All" under the leadership of Dr. Kuldeep K. Lal, Director, ICAR-CIBA. Scientists and staff across its headquarters and regional centres took the Vigilance Pledge and participated in awareness activities, including essay writing, quiz, slogan writing, cartoon drawing and drawing competitions. A valedictory function was held on 31st October 2025 under the Chairmanship of Dr. M. Kailasam, Head, Finfish Culture Division, during which prizes and certificates were distributed, reinforcing the importance of integrity and vigilance in public service. Thiru. P. Mahendran, IPS, Superintendent of Police, Department of Vigilance and Anti-corruption, Government of Tamil Nadu, Chennai attended as the Chief Guest.

Observed the RASHTRIYA EKTA DIWAS (NATIONAL UNITY DAY) 2025

Rashtriya Ekta Diwas was celebrated on 31 October 2025 to commemorate the birth anniversary of Sardar Vallabhbhai Patel, the "Iron Man of India". Scientists, staff, and students took the National Unity Pledge, reaffirming their commitment to the unity, integrity, and security of the nation. The programme featured poster-making activities promoting national integration, while Dr. M. Kailasam, Director In-charge, highlighted Sardar Patel's pivotal role in India's freedom movement and nation-building.

Conducted an outreach activity on shrimp disease management at Amalapuram, Andhra Pradesh

ICAR-CIBA, in collaboration with the Department of Fisheries, Government of Andhra Pradesh, organized an outreach programme at Amalapuram on 19th November 2025 to promote effective management of EHP and White Faeces Syndrome (WFS) using the phytobiotic solution 'CIBA EHP Cura'. Funded by NFDB, the programme was attended by about 110 shrimp farmers and provided technical guidance on disease prevention and sustainable health management in shrimp aquaculture. Dr. T. Sathish Kumar, Senior Scientist and team lead coordinated the program. Dr. S. Anjali, Additional Director, Principal, SIFT, Department of Fisheries, Government of Andhra Pradesh, Mr. Desam Setty Lakshminarayan, Director, APSADA, and Mr. Nagasrinivas, Director, APSADA, attended the meeting and addressed the farmers.

Observed World Antimicrobial Awareness Week (WAAW) at Guru Nanak School, Chennai

World Antimicrobial Awareness Week (WAAW) 2025 was observed from 18–24 November under All India Network Project on Antimicrobial Resistance. Conducted an awareness programme and poster competition on the topic "Power of Antibiotics: Use them wisely" for 56 school students of Gurunanak Matriculation Higher Secondary School, Velachery, Chennai on 21st November with the guidance of Dr. Kuldeep K. Lal, Director, ICAR-CIBA. The programme sensitized students about the importance of responsible antimicrobial use, AMR prevention, and alternative therapies. Participants were encouraged to promote awareness within society, and winners of the poster competition were awarded prizes.

Celebrated World Soil Day at Pattipulam Village, Chengalpattu, Tamil Nadu

On World Soil Day (5 December 2025), ICAR-CIBA organized a Brackishwater Aquaculture Farmers Meet on "Climate Resilient Aquaculture Technologies" at Pattipulam, Tamil Nadu, under the NICRA project. About 80 farmers participated in sessions on soil and water quality management, health management, crab fattening, live feeds, and shrimp–seaweed integrated farming. Demonstrations on soil sampling and onsite water quality monitoring were conducted, and two multiparameter water quality kits were distributed to farmers. Dr. M. Kailasam, HoD, Finfish Culture Division and Director In-charge presided over the programme and the scientific team led by Dr. M. Muralidhar, Principal Scientist coordinated the programme.

Conducted a sensitization programme on EHP-Cura-I at Bapatla, Andhra Pradesh

ICAR-CIBA conducted a sensitization programme at Bapatla, Andhra Pradesh, on 9 December 2025 to raise awareness on shrimp diseases, particularly EHP-induced microsporidiosis, and its management through the EHP-Cura-I intervention. About 160 shrimp farmers, aquaculture professionals, and students participated in the programme. Experts discussed disease prevention, biosecurity, institutional support, regulatory requirements, and aquaculture insurance schemes, providing comprehensive guidance for sustainable and risk-resilient shrimp farming. Shri. Krishna Kishore, Assistant Director of Fisheries, Chirala, Shri. Ram Prasad, Field consultant, CAA and Shri.P. Venkateshwarlu, Deputy Manager, Aquaculture Insurance attended the programme. The scientific team led by Dr.T. Sathish Kumar, Senior Scientist coordinated the event.

Celebrated the Kisan Diwas – 2025 at Muttukadu Experimental Station, Chennai

ICAR-CIBA and its regional centres at Kakdwip and Navsari celebrated National Farmers' Day on 23rd December 2025 with participation from 303 farmers and stakeholders. The programme commemorated the birth anniversary of former Prime Minister of India, Shri. Chaudhary Charan Singh, a dedicated Kisan leader, and highlighted the contributions of farmers to national food security and economic growth. Experts emphasized integrated farming systems involving fisheries and livestock to enhance farm income, sustainability, and resilience to climate and market risks. Dr.M. Kailasam, Head, Fish Culture Division, and Director-in-Charge delivered the Farmers Day address.

Consultancies, Technology Development & Transfer

MoU with M/s. Devi Nutri International Limited, Telangana

ICAR - CIBA signed MoU with M/s. Devi Nutri International Limited, Telangana in the presence of Dr. J. K. Jena, Deputy Director General-Fisheries, ICAR, Mr. Rabindra Kumar Jena, former Member of Parliament, Dr. P. K. Sahoo, Director, ICAR-CIFA, Dr. Kuldeep K. Lal, Director, ICAR-CIBA on 31st October 2025 for evaluating the effect of liquid mineral solution in aquaculture.

MoU with Tamil Nadu Adi Dravidar Housing and Development Corporation Limited (TAHDCO)

ICAR-CIBA signed MoU with Tamil Nadu Adi Dravidar Housing and Development Corporation Limited (TAHDCO) for the implementation of Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) on 4th February 2025. TAHDCO is a Government of Tamil Nadu undertaking that works for the socio-economic development of Adi Dravidar (Scheduled Caste) communities through housing, education support, skill development, and livelihood promotion programmes.

MoU with Mr. Rakesh Shukla, Maharashtra

ICAR-CIBA signed an MoU with Mr. Rakesh Shukla, an aqua entrepreneur from Maharashtra, for validation of Eco-Smart High-Density Precision Shrimp Farming System under PPP mode on 14th February 2025.

MoU with M/s. Bajaj Allianz General Insurance Company Limited, Maharashtra

ICAR-CIBA signed a Memorandum of Understanding with M/s. Bajaj Allianz General Insurance Company Limited, Maharashtra on 27th February 2025 for developing an innovative and comprehensive aquaculture insurance product. This MoU aims to address the gap in aquaculture crop insurance coverage in India through research and development, leveraging expertise in aquaculture science, insurance distribution and risk modelling to create a comprehensive aquaculture insurance product.

MoU with M/s. Nutricape Private Ltd., Tamil Nadu

ICAR-CIBA joined hands with M/s. Nutricape Private Ltd., Tamil Nadu, a dynamic startup dedicated to provide size-optimized bio-encapsulation services tailored specifically for aquafeed manufacturers on 28th February 2025 for evaluating the efficacy of size optimised Nano-encapsulated phytase on the growth of the Pacific white shrimp, *P. vannamei*.

MoU with Kerala University of Fisheries and Ocean studies, Kerala

ICAR-CIBA signed an MoU with the Kerala University of Fisheries and Ocean Studies (KUFOS), Kerala on 25th March 2025 to promote collaborative, student exchanges and faculty interactions between these two institutions and to explore new avenues to improve the fisheries education and the aquaculture farming sector.

MoU with M/s. AVT Natural Products Ltd., Chennai

The institute signed an MoU with the team of Ms. AVT Natural Products Pvt. Ltd., Chennai, a global supplier of plant-based natural extracts and ingredients on 21st May 2025 for evaluating the effect of AVT aqua products on immunity in penaeid shrimps.

MoU with M/s. Uday Aqua Connects Pvt. Ltd., Telangana

A Memorandum of Understanding was signed with Mr. Udaykishan Cherukuneedi, Managing Director, M/s. Uday Aqua Connects Pvt. Ltd on 28th May 2025 for technical and consultancy services for the development of brackishwater aquaculture technologies. Another MoU was signed on 23rd September 2025 for seaweed integrated shrimp farming (SISF) model.

MoU with Rajiv Gandhi Centre for Aquaculture

ICAR-CIBA signed a Memorandum of Understanding with Rajiv Gandhi Centre for Aquaculture (RGCA) for the validation of Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) on 12th June 2025. The agreement supports technology transfer, field trials, farmer training, and hands-on implementation of SIPNSF practices through RGCA's facilities and outreach networks.

MoU with M/s. RS PCR Labs, Andhra Pradesh

ICAR-CIBA signed a Memorandum of Understanding with Mr. Chandaka. Ashok Kumar, Proprietor of a startup company M/s. RS PCR Labs, Kakinada District, Andhra Pradesh, for technology transfer on Multiplex real-time PCR kit for the detection and quantification of *Vibrio harveyi* and *V. campbellii* in aquaculture systems on 23rd June 2025.

MoU with the Hindustan Institute of Technology and Science, Padur, Chennai

ICAR-CIBA inked MoU with Dr. Muthukumar Subramanian, Registrar of Hindustan Institute of Technology and Science (HITS), Padur, Chennai on 23rd June 2025 for a collaboration of research and development in brackishwater aquaculture sector. The aim is to strengthen academic and research collaboration to facilitate student internships, hands-on training, joint research programmes, and knowledge exchange in aquaculture engineering and allied fields, thereby enhancing industry–institute linkage and skill development.

MoU with Blue Aqua Farmers Center, Bhimavaram, Andhra Pradesh

ICAR-CIBA signed an MoU with Blue Aqua Farmers Center, Bhimavaram, Andhra Pradesh on 3rd July 2025 to promote brackishwater aquaculture through collaborative training and research initiatives. The collaboration focuses on joint research & development activities to address current challenges in farming and hatchery operations, including issues such as EHP, Vibriosis, and White Faeces, with the objective of developing effective solutions and Better Management Practices (BMPs) to ensure sustainability in brackishwater aquaculture.

MoU with M/s. V. K. Aqua Feeds, Andhra Pradesh

ICAR-CIBA signed a Memorandum of Understanding with Shri. S. Srikanth Sudheer Reddy of M/s. V. K. Aqua Feeds, Andhra Pradesh on 3rd July 2025 for upscaling and mass production of 'CIBA EHP Cura Gro plus. This phytobiotic-based product is technically designed to control and treat *Ecytonucleospora hepatopenaei* (EHP), a microsporidian that causes huge production losses in shrimp farming and improving immunity, health, survival, and growth of shrimp, thereby offering substantial benefits to the aquaculture industry.

MoU with Prawn Farmers Federation of India, Hyderabad

ICAR-CIBA and Prawn Farmers Federation of India, Hyderabad, entered into a collaborative research agreement on 29th July 2025 to investigate running mortalities linked to White Muscle Disease and White Faeces Syndrome in shrimp farms of Nagapattinam. Through this collaboration, both organizations will undertake systematic investigations and field-level interventions to address the persistent shrimp mortality issues, with the objective of developing science-based solutions and practical management strategies to reduce losses and enhance farm sustainability.

MoU with VR Aqua Fish Farming, Chennai

ICAR-CIBA has entered into an agreement with M/s. VR Aqua Fish Farming, a start-up enterprise based in Chennai on 30th July 2025, for the pilot demonstration of live feed and *Artemia* biomass production technology. The agreement emphasizes technical guidance and support the start-up in establishing a sustainable live feed and *Artemia* biomass production enterprise.

MoU with Society for Elimination of Rural Poverty (SERP), Andhra Pradesh

ICAR-CIBA signed a Memorandum of Understanding with the Society for Elimination of Rural Poverty (SERP), Andhra Pradesh on 23rd August 2025 to provide technical and consultancy services for the development of brackishwater aquaculture technologies in the state. Under this agreement, ICAR-CIBA will serve as the technical consultant in matters covered by the MoU, offering expert guidance and professional support for the promotion and implementation of sustainable aquaculture practices.

MoU with Kona Bay India Pvt. Ltd.

The Institute signed a Memorandum of Understanding with M/s. Kona Bay India Pvt. Ltd. on 2nd September 2025 to undertake performance evaluation trials of shrimp seed lines under the Super Intensive Precision and Natural Shrimp Farming (SIPNSF) system. This MoU aims to generate scientific data on the comparative performance of different shrimp seed lines, thereby enabling farmers to select strains best suited to their specific farming conditions and production goals. The collaborative research outcomes are expected to address the growing demand for high-quality shrimp genetics in the country and support sustainable intensification of shrimp aquaculture.

MoU with M/s. Sandhya Aqua Exports Private Limited

An MoU was signed with M/s. Sandhya Aqua Exports Private Limited on 23rd September 2025 for consultancy services to undertake a pilot-scale demonstration of the Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) technology.

MoU with Centre for Aquatic Livelihood Jaljeevika

MoU was signed with the Centre for Aquatic Livelihood Jaljeevika on 26th September 2025 for the transfer of technology regarding the production of Plankton^{Plus} and Horti^{Plus}.

MoU with Gujarat Fisheries Central Co-operative Association Limited, Gujarat

ICAR-CIBA and Gujarat Fisheries Central Co-operative Association Limited, Gujarat, signed a Memorandum of Understanding on 26th September 2025 for the validation and collaborative implementation of the Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) system at the Association's farm facilities.

MoU with Meghraj International, Haryana

ICAR-CIBA signed an MoU with M/s. Meghraj International, Haryana, on 29th October 2025, to undertake a collaborative study evaluating the effect of High Protein Guar Meal as a dietary ingredient in shrimp, with potential applications in both shrimp and fish farming. The highlight of this MoU is the assessment of its nutritional efficacy, growth performance, feed utilization efficiency, and overall suitability as an alternative protein source in aquaculture feeds.

MoU with Directorate of Fisheries, Dept. of Fisheries, Goa

A Memorandum of Understanding was signed between ICAR-CIBA and the Directorate of Fisheries, Dept of Fisheries, Goa, on 5th November 2025, for the validation and collaborative implementation of the Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) system, developed by ICAR-CIBA. The MoU provides technical guidance to implement and validate the SIPNSF system at the farm.

MoU with M/s. Green Wave Aqua Genesis, Sirkali Taluk, Tamil Nadu

ICAR-CIBA and M/s. Green Wave Aqua Genesis, Sirkali Taluk, Tamil Nadu, signed a Memorandum of Understanding for Super-intensive Precision and Natural Shrimp Farming (SIPNSF) on 12th December 2025. The highlight of the MoU is to provide technical guidance for the validation of the SIPNSF system at their farm facilities.

MoU with Acharya N.G. Ranga Agricultural University, Andhra Pradesh

A Memorandum of Understanding was signed between ICAR-CIBA and Acharya N.G. Ranga Agricultural University, Andhra Pradesh, on 17th December 2025 to promote academic and research collaboration. The main purpose of this MoU is to build a strong scientific partnership and enhance knowledge sharing, especially to support students in identifying research topics and receiving expert guidance in bioinformatics, aquaculture genomics, computational biology, and simulation modelling.

Revenue Generated

SL. NO.	Services offered & Name of the firm	Amount (₹)
1.	Evaluating the Effect of Liquid Mineral Solution in Aquaculture – M/s. Devee Nutri International, Plot No.10, Block-D, 2nd Floor, Street No-1, Patrika Nagar, Madhapur, Hyderabad – 500081, Telangana.	7,08,000
2.	TAHDCO – Super-Intensive Precision Shrimp Farming Technology – Tamil Nadu Adi Dravidar Housing and Development Corporation Ltd. (TAHDCO), #31, Cenotaph Road, 2nd Lane, Teynampet, Chennai – 600018, Tamil Nadu.	6,08,000
3.	Validation of Eco-Smart Super-Intensive Precision and Natural Shrimp Farming – Shri. Rakesh Shukla, Near Sai Baba Temple, At Post Navghar, Saphale (East), Dist. Palghar – 401102, Maharashtra.	2,95,000
4.	Shrimp Crop Insurance – Bajaj Allianz General Insurance Company Limited, Bajaj Allianz House, Airport Road, Yerawada, Pune, Maharashtra.	5,50,000
5.	Evaluating the Efficacy of Size-Optimised Nano-Encapsulated Phytase on Growth of *P. vannamei* – M/s. Nutricape Pvt. Ltd., No. 9/2 (Old 9/1), 14th Street, Nandanam Extension, Chennai – 600035, Tamil Nadu.	7,08,000
6.	Evaluation of AVT Aqua Products on Immunity in Penaeid Shrimps – M/s. AVT Natural Products Ltd., 60, Rukmani Lakshmipathy Salai, Egmore, Chennai – 600008, Tamil Nadu	8,90,000
7.	Technical and Consultancy Services for Development of Brackishwater Aquaculture Technologies – M/s. Uday Aqua Connects Pvt. Ltd., Plot No. 49, Doyens Lakeside Township, Serilingampally, Hyderabad – 500019, Telangana.	11,80,000
8.	Validation of Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) – Rajiv Gandhi Centre for Aquaculture (MPEDA), Karaimedu Village, Sattanathpuram P.O., Sirkali Taluk, Mayiladuthurai District – 609109, Tamil Nadu.	6,00,000
9.	Technology Transfer on Multiplex Real-Time PCR Kit for Detection and Quantification of *Vibrio harveyi* and *V. campbellii* – M/s. RS PCR Labs, Door No. 4-24/1, Gopalapatnam, Station Road, Thondangi Mandal, Annavaram, Kakinada District – 533408, Andhra Pradesh.	2,36,000
10.	Technology Transfer on CIBA EHP Cura Gro Plus – M/s. V.K. Aqua Feeds, 8-549, Ravulapalem, Konaseema, Andhra Pradesh.	5,90,000
11.	Performance Evaluation Trials of Shrimp Seed Lines – M/s. Konabay India Pvt. Ltd., Kotapalem Village, Ranasthalam Mandal, Srikakulam District, Andhra Pradesh.	5,31,000
12.	Consultancy Services for Pilot-Scale Demonstration of SIPNSF Technology – M/s. Sandhya Aqua Group, MIG-25A, Lawsons Bay Colony, Visakhapatnam – 530017, Andhra Pradesh.	7,08,000
13.	Transfer of Technology of Plankton*Plus* and HortiP*lus* Production – Mr. Neelkanth Mishra, 11, Snehkunj Apartments, Jambhulkar Chowk, Vikas Nagar, Wanowrie, Pune – 411040, Maharashtra.	5,90,000
14.	Validation of Super-Intensive Precision and Natural Shrimp Farming (SIPNSF) – Gujarat Fisheries Central Co-operative Association Limited (GFCCA), Dr. Jivraj Mehta Bhavan, Block No.10/2, Gandhinagar – 382010, Gujarat.	17,16,000
15.	Evaluating the Effect of Guar High Protein Meal in the Diet of P. vannamei – M/s. Meghraj International, 17 KM Stone, Panihar Chowk, Hisar – 125001, Haryana.	9,44,000
16.	Promote Brackishwater Aquaculture Development – Directorate of Fisheries, Department of Fisheries, Goa.	6,00,000
17.	Consultancy Services for Pilot-Scale Demonstration of SIPNSF Technology – M/s. Green Wave Aqua Genesis, Thoduvai Village, Sirkali Taluk, Mayiladuthurai District, Tamil Nadu.	7,08,000
	TOTAL	**1,21,62,000**

Awards and Recognitions

1. Dr. T. Sathish Kumar – **"Dr. Hiralal Chaudhari Young Scientist Award (2025)"** by the ICAR-Central Institute of Fisheries Education (CIFE) at Mumbai on 6th June 2025.

2. Dr. Raymond Jani Angel – **'Dr. P.S.B.R. James Memorial Award'** for Best Poster Presentation during the MECOS 4 held from 4-6, November 2025 at ICAR-CMFRI, Kochi.

3. Dr. P. Ezhil Praveena – **"IAVP Best Women Veterinary Pathologists for the year 2025"** during the 42nd Annual Conference of Indian Association of Veterinary Pathologists-IAVPCON25 held from 4 -6, December 2025 at Ranchi Veterinary College, Jharkhand, India.

4. Dr. M. Makesh – **"Best Oral Presentation Award"** at the 12th International Symposium on Diseases in Asian Aquaculture held during 23-27, September 2025 at Chennai.

5. Dr. Subhendu Kumar Otta – **"Best Oral Presentation Award"** at the 12th International Symposium on Diseases in Asian Aquaculture held during 23-27, September 2025 at Chennai.

6. Dr. P. Ezhil Praveena – **"IAVP – Best Oral Presentation Award"** in the session Lab, Aquatic and Wild animal pathology during the 42nd Annual Conference of Indian Association of Veterinary Pathologists- IAVPCON25, held from 4 -6, December 2025 at Ranchi Veterinary College, Jharkhand, India.

Dr. T. Sathish Kumar received the " Dr. Hiralal Chaudhari Young Scientist Award -2025"

Linkage & Collaboration

The Institute maintained linkages with the following national and international organisations

ICAR INSTITUTES

ICAR – Central Marine Fisheries Research Institute, Kochi, Kerala
ICAR – Central Inland Fisheries Research Institute, Barrackpore, West Bengal
ICAR – Central Institute of Fisheries Technology, Kochi, Kerala
ICAR – Central Institute of Fisheries Education, Mumbai, Maharashtra
ICAR – National Bureau of Fish Genetic Resources, Lucknow, Uttar Pradesh
ICAR – Central Institute of Freshwater Aquaculture, Bhubaneswar, Odisha
ICAR – Directorate of Coldwater Fisheries Research, Bhimtal, Uttarakhand
ICAR – Central Island Agricultural Research Institute, Sri Vijaya Puram, Andaman and Nicobar Islands
ICAR – Central Research Institute for Dryland Agriculture, Hyderabad, Telangana
ICAR – National Academy of Agricultural Research Management, Hyderabad, Telangana

OTHER CENTRAL / STATE GOVERNMENT DEPARTMENTS, SAUs / FOREIGN INSTITUTIONS

Agricultural and Processed Food Products Export Development Authority, New Delhi
Centre for Advanced studies in Marine Biology, Annamalai University, Parangipettai, Tamil Nadu
Centre for Environment Fisheries and Aquaculture Science (CEFAS), Weymouth, Dorset, UK
Coastal Aquaculture Authority, Chennai, Tamil Nadu
College of Fisheries, University of Agricultural Sciences, Mangaluru, Karnataka
College of Fisheries, Fisheries University, Muthukuru
CSIR-Electrochemical Research Institute, Karaikudi, Tamil Nadu
Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, New Delhi
Department of Biotechnology, New Delhi
Fisheries College and Research institute, Thoothukudi, Tamil Nadu
ISRO Telemetry Tracking and command Network (ISTRAC), Peenya Industrial Area, Bengaluru, Karnataka
Agency for Development of Aquaculture Kerala (ADAK), Government of Kerala, Kerala
Indian Institute of Technology, Chennai, Tamil Nadu
Indian Institute of Technology, Kharagpur, West Bengal
Mangrove Cell, Government of Maharashtra, Mumbai, Maharashtra
Ministry of Science and Technology, New Delhi
Ministry of Water Resources, New Delhi

Marine Products Export Development Authority, Kochi, Kerala
MS Swaminathan Research Foundation, Chennai, Tamil Nadu
National Fisheries Development Board, Hyderabad, Telangana
National Institute of Ocean Technology, Chennai, Tamil Nadu
Navsari Agricultural University, Navsari, Gujarat
Sundarban Development Board, Govt. of West Bengal, West Bengal
Dep. of Agriculture, Govt. of West Bengal, West Bengal
Ramakrishna Ashram KVK, Nimpith, South 24 Parganas, West Bengal
Nature Environment and Wildlife Society (NEWS), Kolkata, West Bengal
South Asian Forum for Environment (SAFE), Kolkata, West Bengal
Pinnacle Biosciences, Tamil Nadu
Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu
Tamil Nadu Veterinary and Animal Science University, Chennai, Tamil Nadu
Tamil Nadu Dr. J. Jayalalithaa Fisheries University, Nagapattinam, Tamil Nadu
The Pirbright Institute, UK
University of Madras, Chennai, Tamil Nadu
University of Southampton, UK
Vellore Institute of Technology, Vellore, Tamil Nadu
Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, Tamil Nadu
West Bengal University of Animal and Fisheries Science, Kolkata , West Bengal
Crescent Innovation Incubation Council (CIIC), BSAR Crescent Institution of Science & Technology, Chennai, Tamil Nadu
Sathyabama Institute of Science and Technology, Rajiv Gandhi Salai, Chennai, Tamil Nadu
Shri A. M. M. Murugappa Chettiar Research Centre, Chennai, Tamil Nadu
SSN College of Engineering, Tamil Nadu
SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu
The Neotia University, West Bengal
Guwahati University, Assam
NITTE University, Mangaluru, Karnataka
Indian Immunologicals Limited, Hyderabad, Telangana
Guru Angad Dev Veterinary and Animal Sciences University (GADVASU) Ludhiana, Punjab
Kerala University of Fisheries and Ocean studies, Kochi, Kerala
Hindustan Institute of Engineering Technology, Chennai, Tamil Nadu
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh

STATE FISHERIES DEPARTMENTS

The institute has well established linkage with state fisheries departments mainly for transfer of technologies

Official Language Implementation Program

राजभाषा

संसदीय राजभाषा समिति की दूसरी उपसमिति द्वारा आईसीएआर-सीबा चेन्नै का निरीक्षण पुडुचिरी में किया गया.

संसदीय राजभाषा समिति की दूसरी उप-समिति ने दिनांक 07 जनवरी 2025 को पुडुचिरी में संस्थान के साथ एक निरीक्षण बैठक की। बैठक के दौरान, राजभाषा संबंधी संसदीय समिति की ओर से लोकसभा से माननीय उपाध्यक्ष श्री भर्तृहरि महताब जी, संयोजक श्री उज्जवल रमन सिंह जी व समिति सदस्य – श्री कुलदीप इंदौरा जी, श्री हरि भाई पटेल जी और श्री शंकर लालवानी जी उपस्थित थे। उप-समिति के माननीय सदस्यों के अतिरिक्त समिति के सचिव श्री प्रेम नारायण, वरिष्ठ अनुसन्धान अधिकारी श्री इरफान अहमद खान, हिंदी अधिकारी श्री मनोज कुमार एवम समिति रिपोर्टर श्री मोहम्मद आरिफ शामिल थे। वहीं, भारतीय कृषि अनुसंधान परिषद मुख्यालय की ओर से प्रधान वैज्ञानिक डॉ. प्रेम कुमार, उप निदेशक (राजभाषा) श्री राम दयाल शर्मा और मुख्य तकनीकी अधिकारी श्री ओम प्रकाश जोशी ने अपनी उपस्थिति दर्ज कराई। संस्थान की तरफ से निदेशक महोदय डॉ. कुलदीप के. लाल, डॉ. एम. एस. शशि शेखर , डॉ. सुजीत कुमार एवम श्री नवीन कुमार झा आदि उपस्थित थे।

समिति ने संस्थान में राजभाषा (हिंदी) से संबंधित किए जा रहे कार्यों का निरीक्षण किया। समिति द्वारा संस्थान के राजभाषा निरीक्षण में हिंदी के प्रयोग व कार्यांवयन को उत्कृष्ट पाया गया तथा संस्थान के निदेशक महोदय को निरीक्षण प्रमाण पत्र प्रदान किया गया।

संसदीय राजभाषा समिति

गृह मंत्रालय / भारत सरकार

निरीक्षण प्रमाण-पत्र

संसदीय राजभाषा समिति का गठन राजभाषा अधिनियम 1963 की धारा 4 के तहत वर्ष 1976 में किया गया। यह एक विशेषाधिकार प्राप्त समिति है। इस समिति में 30 संसद सदस्य हैं, 20 लोक सभा से और 10 राज्य सभा से। माननीय गृह मंत्री जी इस समिति के अध्यक्ष हैं। इस समिति का प्रमुख कार्य संघ के राजकीय प्रयोजनों के लिए हिंदी के प्रयोग में हुई प्रगति का पुनरीक्षण और समीक्षा कर सिफारिशें करते हुए अपनी रिपोर्ट माननीय राष्ट्रपति जी को प्रस्तुत करना है।

इसी क्रम में संसदीय राजभाषा समिति द्वारा दिनांक 03.01.2025 को आकृअनुप-केंद्रीय खारा जलजीव पालन अनुसंधान संस्थान, चेन्नई का निरीक्षण किया गया। समिति द्वारा निरीक्षण में आपके कार्यालय में राजभाषा हिंदी के प्रयोग व कार्यान्वयन को उत्कृष्ट/ अच्छा/संतोषजनक पाया गया।

(भर्तृहरि महताब)
उपाध्यक्ष
संसदीय राजभाषा समिति

(उज्जवल रमण सिंह)
संयोजक
दूसरी उप-समिति

कार्यालय का पता: 11, तीन मूर्ति मार्ग, नई दिल्ली-110011, दूरभाष : 011-21411167
Email: us2nddsubcommittee@gmail.com

आईसीएआर-सीबा, मुख्यालय में दिनांक 14 से 20 सितंबर, 2025 के दौरान हिंदी सप्ताह मनाया गया

आईसीएआर-सीबा, चेन्नई ने राजभाषा के रूप में हिंदी के उपयोग को बढ़ावा देने के लिए 14-20 सितंबर 2025 के दौरान हिंदी सप्ताह मनाया। सप्ताह के दौरान हिंदी नोटिंग, ड्राफ्टिंग, अनुवाद, गायन और प्रश्नोत्तरी प्रतियोगिताओं का आयोजन किया गया। सीबा के निदेशक डॉ. कुलदीप के. लाल ने वार्षिक प्रतिवेदन 2024 (हिंदी संस्करण) का विमोचन किया साथ ही हिंदी में आज का शब्द के प्रदर्शन के लिए समर्पित टेलीविजन के साथ डिजिटल नोटिस बोर्ड का उद्घाटन किया और समापन समारोह के दौरान हिंदी प्रोत्साहन योजनाओं के तहत विजेताओं को पुरस्कार वितरित किए। अपने संबोधन में, सीबा के निदेशक ने भारत की भाषाई विविधता और पूरे देश में संचार करने में हिंदी के महत्व पर टिप्पणी की। उन्होंने उल्लेख किया कि हिंदी कक्ष सीबा के अथक प्रयास से वार्षिक प्रतिवेदन का हिंदी संस्करण प्रकाशित कर रहा है जिस हेतु उन्होने सम्पादन समिति की भूरि-भूरि प्रशंसा की। इस अवसर पर निदेशक ने बताया कि संस्थान तमिल, ओडिया, तेलुगु, गुजराती, बंगाली और गुजराती आदि भाषाओं में प्रकाशनों की एक श्रृंखला जारी की है जिसकी प्रशंसा सभी मत्स्यपालक कर रहे है और उन्हे स्थानीय भाषा में इससे लाभ मिल रहा है। हरित पर्यावरण को बढ़ावा देने के लिए, हिंदी सप्ताह के प्रश्नोत्तरी (क्विज) विजेता को सजावटी पौधे उपहार स्वरूप दिए गए। निदेशक महोदय ने इस अनूठी पहल की सराहना की । श्री नवीन कुमार झा, मुख्य प्रशासनिक अधिकारी एवम प्रभारी हिंदी कक्ष ने हिंदी सेल द्वारा संस्थानों में किए गए कार्यों को प्रस्तुत किया। संस्थान के प्रभागाध्यक्ष एवम सदस्य ओएलआईसी डॉ. एम. एस. शशि शेखर ने संस्थान में हिंदी प्रतियोगिता में वैज्ञानिकों, अधिकारियों और छात्रों की बढ़ती हुई प्रतिभागिता पर प्रसन्नता व्यक्त की। कार्यक्रम का संचालन संस्थान के प्रधान वैज्ञानिक डॉ. सुजीत कुमार एवम समन्वय श्री अश्विन हरिदास, प्रशासनिक अधिकारी ने किया।

हिंदी सप्ताह के दौरान निदेशक, सीबा द्वारा वार्षिक प्रतिवेदन 2024 का विमोचन

हरित पर्यावरण को बढ़ावा देने के लिए, हिंदी सप्ताह के प्रश्नोत्तरी (क्विज) विजेता को सजावटी पौधे उपहार स्वरूप दिए गए।

हिन्दी सप्ताह 2025 के समापन समारोह में राजभाषा सम्बंधित प्रतियोगिता में पुरस्कार व प्रमाणपत्र प्रदान किया गया ।

आईसीएआर-सीबा चेन्नै को नराकास (टोलिक) शिल्ड मिला

आईसीएआर-सीबा को लघु श्रेणी कार्यालयों के अंतर्गत द्वितीय पुरस्कार के रूप में नरकास (टोलिक) शील्ड 2025 एवम प्रमाण पत्र प्राप्त हुआ है। संस्थान के निदेशक महोदय ने विज्ञान सभागार, सीएसआईआर परिसर, मद्रास में महाप्रबंधक, दक्षिण रेलवे, टोलिक अध्यक्ष से यह पुरस्कार 22 नवम्बर को 2025 को ग्रहण किया।

आईसीएआर-सीबा को लघु श्रेणी कार्यालयों के अंतर्गत द्वितीय पुरस्कार के रूप में टोलिक शील्ड 2025 दिनांक 21.11.2025 को प्राप्त हुआ है। निदेशक महोदय ने विज्ञान सभागार, सीएसआई-आर परिसर, मद्रास में महाप्रबंधक, दक्षिण रेलवे, टोलिक अध्यक्ष से यह पुरस्कार ग्रहण किया।

हिन्दी सप्ताह 2025 के समापन समारोह में राजभाषा सम्बंधित प्रतियोगिता में पुरस्कार व प्रमाणपत्र प्रदान किया गया ।

Research & Administrative Meetings

Research Advisory Committee (RAC)

The Research Advisory committee of CIBA was constituted by ICAR for a period of three years from January 1st, 2023 to December 31st, 2025.

Chairman	**Dr. Iddya Karunasagar** Senior Director (International Relations, NITTE University) & Former Senior Fishery Industry Officer, FAO
Members	**Dr. A. Laxminarayan** Former Head (Environment Division) ICAR-CMFRI, Kochi
	Prof. T. J. Abraham Faculty of Fisheries Sciences WBUAFS, Kolkata
	Dr. A. K. Pal Former Joint Director ICAR-CIFE, Mumbai
	Dr. M. Sudhakar Former Scientist G and Director CMLRE, Kochi
	Dr. Shubhadeep Ghosh Assistant Director General (M.Fy.) ICAR, New Delhi
	Dr. Kuldeep K. Lal Director, ICAR CIBA, Chennai
Member Secretary	**Dr. K. P. Kumaraguru Vasagam** Principal Scientist, ICAR-CIBA, Chennai

The 30th Meeting of the Research Advisory Committee (RAC) of ICAR-CIBA was held during 6-7, February 2025.

Institute Research Council (IRC)

The 42nd IRC meeting was held during 1-4 April 2025 and Mid-term IRC Meeting during 9-10 October 2025 at CIBA headquarters, Chennai.

Chairman	**Dr. Kuldeep K. Lal, Director**
Members	**Dr. C. P. Balasubramanian** Principal Scientist & HoD, CCD
	Dr. M. Kailasam Principal Scientist & HoD, FCD
	Dr. M. S. Shekhar Principal Scientist & HoD, AAHED
	Dr. K. Ambasankar Principal Scientist & HoD, NGBD
	Dr. T. Ravisankar Principal Scientist & SIC-SSD
	Dr. Debasis De Principal Scientist & Head, KRC
	Dr. Akshaya Panigrahi Principal Scientist & SIC-NGRC
	Principal Investigators of all the projects
Member Secretary	**Dr. Ashok Kumar Jangam** Principal Scientist

Quinquennial Review Team (QRT)

The Quinquennial Review Team of CIBA was constituted by Indian Council of Agricultural Research (ICAR) to review the work done by CIBA during the period 1st April 2019 to 31st March 2024. The QRT comprised the following members:

Chairman	**Dr. Gopal Krishna** Former Director, ICAR-CIFE, Mumbai
Members	**Dr. Kanta Das Mohapatra** Former Principal Scientist, ICAR-CIFA, Bhubaneswar
	Dr. K. V. Rajendran Former Principal Scientist, ICAR-CIFE, Mumbai
	Dr. K. G. Padmakumar Director, International Resource & Training Centre for Below Sea Level Farming, Kuttanad, Kerala
	Dr. Vijay Gopal Former Principal Scientist, ICAR-CMFRI, Cochin
	Dr. R. Roy Burman Asst. Director General (Agri. Extn.), ICAR, New Delhi
Member Secretary	**Dr. M. S. Shekhar** Principal Scientist & Head-AAHED, ICAR-CIBA, Chennai

A preliminary virtual meeting was convened by DDG (Fisheries Science Division) with QRT Chairman and members on 28th October 2025 for setting timelines and roadmap. The QRT Meeting held at ICAR-CIBA headquarters during 1-3 December 2025. The Team visited Navsari-Gujarat Research Centre on 14th December 2025 and Kakdwip Research Centre during 19-20 December 2025. The final QRT Meeting held at headquarters on 5th March, 2026.

Institute Management Committee

The Institute Management Committee has been constituted as follows:

Chairman	**Dr. Kuldeep K. Lal** Director
Members	**Shri Senthil Nathan, P.** Farmers' Representative
	Shri S. Elangovan Farmers' Representative
	Dr. R. Narayana Kumar Principal Scientist & SIC, CMFRI Regional Station, Chennai
	Dr. Ajith Kumar, T. T. Head, ICAR-The Peninsular Aquatic Genetic Resources, ICAR-NBFGR, Kochi
	Dr. T. Raja Swaminathan Head of Division, CIFT, Cochin
	Dr. Paramita Sawant Banerjee Principal Scientist, ICAR–CIFE, Mumbai
	Dr. Devika Pillai Assistant Director General (Inland Fisheries) ICAR, New Delhi
	Shri Kunal Kalia Deputy Director (Finance), ICAR, New Delhi
Co-Opted Members	**Shri Navin Kumar Jha** Chief Administrative Officer & Head of Office ICAR- CIBA
	Dr. Prasanna Kumar Patil Principal Scientist & OIC, PME Cell, ICAR- CIBA
	Dr. P. Mahalakshmi Principal Scientist & OIC, Engineering Cell ICAR- CIBA
	Smt. Komal Sheokand Chief Finance & Accounts Officer, ICAR- CIBA
	Shri P. Srikanth Finance & Accounts Officer, ICAR- CIBA
	Smt. E. Mary Desouza Asst. Administrative Officer (Stores), ICAR- CIBA
Ex-officio members	The Commissioner of Fisheries and Fishermen Welfare Department, Nandanam, Chennai
	The Commissioner of Fisheries State Fisheries Department, Gandhinagar
	The Vice – Chancellor Tamil Nadu Dr. J. Jayalalitha Fisheries University Nagapattinam
Member Secretary	**Shri Aswin Haridas** Administrative Officer, ICAR- CIBA

Institutional Animal Ethics Committee (IAEC)

Chairperson & Scientist from different biological discipline	**Dr. M. S. Shekhar** Principal Scientist & HoD-AAHED, ICAR-CIBA
Main Nominee	**Dr. S. Vairamuthu** Professor & Head (Rtd.), TANUVAS, Chennai
Link Nominee	**Dr. N. Pazhanivel** Director, Center for Animal Health Studies, TANUVAS, Chennai
Scientist from outside of the Institute	**Shri Ravichandran, M.** Kemin Industries, Gummidipoondi
Socially aware Nominee	**Dr. B. R. Senthilkumar** Assistant Professor National Institute of Siddha, Chennai
Veterinarian	**Dr. T. Bhuvaneswari** Senior Scientist, ICAR-CIBA
Biological Scientist	**Dr. N. Lalitha** Senior Scientist, ICAR-CIBA
Scientist from different biological discipline	**Dr. K. P. Sandeep** Senior Scientist, ICAR-CIBA
Member Secretary & Scientist Incharge of Animal House Facility	**Dr. R. Ananda Raja** Principal Scientist, ICAR-CIBA

Institutional Biosafety Committee (IBSC)

Chairman	**Dr. M. Makesh** Principal Scientist, ICAR-CIBA
Biosafety Officer	**Dr. Amuthavalli** Professor, Madras Medical College, Chennai
Internal Members	**Dr. Sujeet Kumar** Principal Scientist, ICAR-CIBA
	Dr. Raymond Jani Angel Senior Scientist, ICAR-CIBA
	Dr. Aritra Bera Senior Scientist, ICAR-CIBA
Outside Expert	**Dr. K. G. Tirumurugan** Dept of Animal Biotechnology Madras Veterinary College, Chennai
DBT Nominee	**Dr. B. Samuel Masilamoni Ronald** Professor, Dept. of Veterinary Microbiology Madras Veterinary College, Chennai
Member Secretary	**Dr. Sherly Tomy** Principal Scientist, ICAR-CIBA

Institute Joint Staff Council (IJSC)

The Composition of the Institute Joint Staff Council was re-constituted by ICAR-CIBA for a period of three years with effect from 18.11.2025 to 17.11.2028 (office order F.No.13-1/2012-Admn Vol-VIII of 18th November 2025)

OFFICIAL SIDE	
Chairman	**Dr. Kuldeep K. Lal** Director
Members	**Dr. M. S. Shekhar** Principal Scientist & Head-AAHED
	Dr. M. Jayanthi Principal Scientist & Head i/c-CCD
	Dr. R. Geetha Senior Scientist
	Dr. A. Nagavel Asst. Chief Technical Officer
	Shri P. Srikanth Finance & Accounts Officer
Member Secretary	**Shri Aswin Haridas** Administrative Officer

STAFF SIDE	
Secretary (Staff Side) & Member – CJSC Representative	**Shri N. Jagan Mohan Raj** Technical Officer
Member (Admn. Representative)	**Shri V. Kishorkumar** Lower Division Clerk
	Shri S. Solin Igneshus Lower Division Clerk
Member (Tech. Representative)	**Shri N. Jagan Mohan Raj** Technical Officer
	Shri S. Prabhu Senior Technical Assistant
Member (SSS. Representative)	**Shri R. Mathivanan** Skilled Support Staff
	Shri M. Sakthivel Skilled Support Staff

Grievance Committee

Chairman	**Dr. K. Ambasankar** Principal Scientist & Head-NGBD
Member	**Shri Aswin Haridas** Administrative Officer
	Shri P. Srikanth Finance & Accounts Officer

Internal Committee (IC) for Sexual Harassment electronic Box (SHe-Box) Portal

Chairperson	**Dr. M. Jayanthi** Principal Scientist & Head i/c-CCD
Members	**Dr. R. Saraswathy** Principal Scientist & OIC-Library
	Dr. Sherly Tomy Principal Scientist
	Dr. R. Ananda Raja Principal Scientist
	Shri Aswin Haridas Administrative Officer
	Ms. R. Jayasri Assistant
	Smt. B. Prasanna Devi Assistant
External Member	**Dr. Geni Philipose** Assistant Professor School of Law Hindustan Institute of Technology and Science, Chennai

Women Cell

Chairperson	**Dr. M. Jayanthi** Principal Scientist & Head i/c-CCD
Members	**Dr. Vidya Rajendran** Senior Scientist
	Smt. Mary Lini Scientist
	Smt. R. Vetrichelvi Assistant
	Smt. M. Mathuramuthu Bala Assistant
	Smt. B. Prasanna Devi Assistant
Member Secretary	**Smt. Komal Sheokand** Chief Finance & Accounts Officer

Services and Assignments

Dr. Kuldeep K. Lal, Director

- Parliamentary Committee on Official Language meeting, held at Ocean Spray Resort, Puducherry on 7th January 2025.
- Meeting of SMD (Fisheries) with Fisheries Research Institutes regarding finalization of RE and BE, held on virtual mode at SMD (Fisheries), ICAR, New Delhi on 9th January 2025.
- Meeting with regard to review of the status of expenditure against the Budget allocation 2024-25, chaired by Shri. Sanjay Pathak, Joint Secretary (Finance), ICAR, held at ICAR, New Delhi on 15th January 2025.
- Technical Seminar on Bio-Security Management of Shrimp Farming – Black tiger and vannamei shrimp, organized by M/s. Grasim Industries Limited, Aditya Birla Group, Mumbai, held at Surat on 24th January 2025.
- AquaIP – An Online Awareness Program on IPR, jointly organized by the IPTM Unit of ICAR and ZTM-Agribusiness Incubation Centre of ICAR-CIFT, Kochi, on virtual mode, with a session chaired on "Technology Commercialization in Agriculture," held on 29th January 2025.
- Inaugural session of the International Conference on "Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods," organized by Indian Society of Dryland Agriculture (ISDA), held on virtual mode at ICAR-CRIDA, Hyderabad on 29th January 2025.
- 14th Asian Fisheries Aquaculture Forum, organized by Asian Fisheries Society, Kuala Lumpur, Malaysia, ICAR and Asian Fisheries Society Indian Branch, Mangaluru, held at ICAR Convention Centre, NASC, New Delhi from 12-15 February 2025.
- Aquaculture Innovation Tech 2.0, organized by Global Forum for Sustainable Transformation (GFST) and Department of Fisheries, Government of Andhra Pradesh, held at Fortune Murali Park, Vijayawada from 16-18 February 2025.
- 31st Meeting of the Scientific Panel on Fish and Fisheries Products, organized by FSSAI, held on virtual mode on 27th February 2025.
- 38th Convocation of Regional Centre of Indira Gandhi National Open University (IGNOU), Chennai, held at Dwaraka Doss Goverdhan Doss Vaishnav College, Chennai on 5th March 2025.
- 60th Academic Council Meeting of ICAR-CIFE, held at ICAR-CIFE, Mumbai, on 7th March 2025.
- XVIII Convocation of ICAR-CIFE, held at ICAR-CIFE, Mumbai, on 8th March 2025.
- 73rd Executive Committee Meeting of RGCA, held at MPEDA, Kochi, on 26th March 2025.
- 80th Meeting of Coastal Aquaculture Authority, held in virtual mode at the Coastal Aquaculture Authority, Chennai on 3rd April 2025.
- Meeting of the Hon'ble Fisheries Ministers of the Coastal States / UTs, organized under the chairmanship of Shri. Rajiv Ranjan Singh, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying, GoI, to review the progress and implementation of PMMSY schemes and overall development of fisheries, held at Hotel Taj Mahal Palace, Mumbai on 28th April 2025.
- Monthly Meeting of the Fisheries Research Institutes, convened by DDG (Fy.), held on virtual mode at SMD (Fisheries), ICAR, New Delhi, on 1st May 2025.
- Review Meeting of the All India Network Project on Fish Health, held at NASC Complex, New Delhi, on 7th May 2025.
- Expert Consultation Workshop on "Aquaculture medicines: Research, policy and implementation", organized by ICAR-CIBA,

held at NASC Complex, New Delhi, from 8 to 9 May 2025.

- Annual Meet of Vice-Chancellors of Agricultural Universities and Director Conference of ICAR Institutes, held at Bharat Ratna C. Subramaniam Auditorium, NASC Complex, New Delhi on 20th May 2025.
- Workshop-cum-Brainstorming Session on the current status and development of a roadmap for genome editing in aquaculture species in India, organized by ICAR-CIFA and held at ICAR-CIFA, Bhubaneswar, on 14th June 2025.
- Presentation meeting of the project proposal "Geospatial Mapping of Potential Zones for the Expansion of Responsible Aquaculture in Gujarat, Based on Environmental Characteristics and Regulations", submitted by ICAR-CIBA, held at the Agriculture, Farmers Welfare & Cooperation Department, Government of Gujarat, Sachivalaya, Gandhinagar, on 19th June 2025.
- Launch of Livelihood Business Incubator (LBI) Project under MSME by Gauhati University, in technical collaboration with ICAR-CIBA, held at Gauhati University, Guwahati, on 16th June 2025.
- Presentation Meeting of the project proposal "Geospatial Mapping of Potential Zones for the Expansion of Responsible Aquaculture in Gujarat, based on Environmental Characteristics and Regulations", submitted by ICAR-CIBA, held at the Department of Fisheries, Government of Gujarat, Gandhinagar, on 19th June 2025.
- 81st Meeting of Coastal Aquaculture Authority, held at Hotel Le-Meridien, Chennai on 30th June 2025.
- Seafood Expo Bharat 2025, organized by the Marine Products Export Development Authority, Kochi, held at Chennai Trade Centre, Chennai, from 1st to 2nd July 2025.
- The Second Indian Fisheries Outlook 2025, organized by Odisha University of Agriculture and Technology (OUAT), was held at OUAT, Bhubaneswar, from 13th to 14th July 2025.
- 97th Foundation Day of ICAR, held at Bharat Ratna Dr. C. Subramaniam Auditorium, NASC Complex, New Delhi, on 16th July 2025.
- Meeting to discuss technical and administrative matters pertaining to the Institute, including formulation of EFC for the next five years and action plan of Vision 2047, held under the chairmanship of DDG (Fy.), ICAR at SMD (Fisheries), ICAR, New Delhi on 17th July 2025.
- 34th Meeting of the Scientific Panel on Fish and Fisheries Products of FSSAI, held at FSSAI, New Delhi, on 21st July 2025.
- Meeting to discuss the proposal of Prawn Farmers Federation of India (PFFI) for a joint study on RMS-WFD and its surveillance, organized by MPEDA, Kochi, held at MPEDA, Kochi on 24th July 2025.
- Meeting with the Fisheries Research Institutes, chaired by DDG (Fy.), ICAR, to discuss Vision 2050 of the Institutes, held on virtual mode at SMD (Fisheries), ICAR, New Delhi, on 28th July 2025.
- Meeting held under the Chairmanship of Hon'ble Minister of Agriculture and Farmers Welfare, GoI, regarding release of the 20th installment of PM-KISAN Scheme, through video conferencing, held at Ministry of Agriculture & Farmers Welfare, GoI, New Delhi on 30th July, 2025.
- Meeting with the Fisheries Research Institutes, chaired by DDG (Fy.), ICAR, to discuss Vision 2050 of the Institutes, held on virtual mode at SMD (Fisheries), ICAR, New Delhi, on 30th July 2025.
- Programme of Hon'ble Minister of Agriculture and Farmers Welfare, GoI, regarding release of the 20th installment of PM-KISAN Scheme at Varanasi, through video conferencing, held at Ministry of Agriculture & Farmers Welfare, GoI, New Delhi on 2nd August 2025.
- Meeting on the impact of tariffs imposed by America on India, organized by the Department of Fisheries, Government of Maharashtra, held in virtual mode on 13th August 2025.
- First Meeting of the State Level Coordination Committee of VKSA Puducherry UT, organized by ICAR-CIBA, held at ICAR-CIBA, Chennai on 8th September 2025.
- Second Meeting of the State Level Coordination

Committee of VKSA Puducherry UT, held at ICAR-CIBA, Chennai on 12th September 2025.

- First Meeting of the Expert Committee constituted to revisit the Standard Operating Procedure (SOP) for import of Specific Pathogen Free broodstock of crustacean and artemia from South East Asian countries, organized by ICAR-CIBA, held on virtual mode at ICAR-CIBA, Chennai, on 15th September 2025.
- 82nd Meeting of Coastal Aquaculture Authority, held on virtual mode at CAA, Chennai on 16th September 2025.
- Second Meeting of the Expert Committee constituted to revisit the Standard Operating Procedure (SOP) for import of Specific Pathogen Free broodstock of crustacean and artemia from South East Asian countries, organized by ICAR-CIBA, held on virtual mode at ICAR-CIBA, Chennai, on 17th September 2025.
- 3rd Meeting of the Expert Committee on SOP for import of SPF broodstock of crustaceans and artemia from South East Asian countries, held at CAA, Chennai on 19th September 2025.
- Meeting under the Chairmanship of Secretary, DARE & DG, ICAR, to discuss VKSA RABI 2025 Programme, held at ICAR, New Delhi on 24th September 2025.
- Awareness Programme and live streaming of the Hon'ble Prime Minister's programme on the schemes and programmes of the Government of India for the benefit of the farming community, held at MES of CIBA, Muttukadu, on 11th October 2025.
- Meeting on Communication Plan, held through video conferencing on 22nd October 2025.
- Meeting with all DDGs, Directors, ADGs, FA, DARE / ICAR to brief about the meeting held with all the Secretaries of the Government of India, held at ICAR, New Delhi, on 28th October 2025.

Memberships in Committees/Societies/ Boards:

- Executive Committee and Governing Body, Rajiv Gandhi Centre for Aquaculture (MPEDA), Mayiladuthurai.
- ICAR Regional Committee No. VIII.
- Executive Committee Member - National Centre for Sustainable Aquaculture (NaCSA).
- Coastal Aquaculture Authority.
- Director – Board of Tamil Nadu Fisheries Development Corporation Limited, Chennai.
- Extension Council of ICAR-Central Institute of Fisheries Education, Mumbai.
- Board of Management of ICAR - Central Institute of Fisheries Education, Mumbai.
- Academic Council of ICAR-Central Institute of Fisheries Education, Mumbai.
- Scientific Advisory Committee, Krishi Vigyan Kendra, Tiruvallur.
- Scientific Advisory Committee, Dr. Perumal Krishi Vigyan Kendra.
- Scientific Advisory Committee, ICAR-Krishi Vigyan Kendra, Tiruvannamalai.
- National Committee on Introduction of Exotic Aquatic Organisms into Indian waters, constituted by the Ministry of Agriculture & Farmers Welfare, DAHDF, Govt. of India, New Delhi.
- Advisory Committee on Hilsa Conservation and Research.
- Technical Advisory Committee for the GNF-BMZ Project "Building a transnational, civil society partnership to increase the resilience of coastal population in South Asia", constituted by the Governing Board of Centre for Research on New International Economic Order (CReNIEO), Chennai.
- Scientific Panel on Fish and Fisheries Research Products, constituted by the Food Safety and Standards Authority of India, New Delhi.
- Expert Committee to draft Rules/Regulations and Guidelines for "The Coastal Aquaculture Authority (Amendment) Act, 2023", constituted by the Department of Fisheries, Ministry of Fisheries, Animal Husbandry & Dairying, Govt. of India.
- Sub-Committee on "SPS

& Quality Assurance for Marine Products Export Promotion" constituted by MPEDA, Kochi.

- Sub-Committee on Species Diversification & New Technology Adoption for Marine Products Export Promotion, constituted by MPEDA, Kochi.
- Sub-Committee on Aquaculture Regulation & Traceability for Marine Products Export Promotion, constituted by MPEDA, Kochi.
- Society of Coastal Aquaculture and Fisheries (SCAFi).
- Member - Asian Fisheries Society Indian Branch & Councilor, Asian Fisheries Society, Kuala Lumpur.
- Technical Committee constituted to oversee and monitor the functioning of the Aquatic Quarantine Facility, constituted by Coastal Aquaculture Authority.
- Committee on Fixation of Fee in respect of Affiliated Agricultural Colleges of Tamil Nadu.
- State Level Technical Committee (SLTC) to review and fix the scale of finance for various crops and working capital assistance for Fisheries and Animal Husbandry, constituted by Agriculture Department, Govt. of Tamil Nadu.
- Expert Committee on Normally Traded as Commodities (Freshwater, Brackishwater and Marine Biological Resources), constituted by National Biodiversity Authority.
- Task Force for overall development of Ornamental Fisheries in the Country, constituted by the Department of Fisheries, MFAHD, Govt. of India.
- Committee for drafting the National Framework on Traceability system for Fisheries & Aquaculture in India, constituted by the Department of Fisheries, MFAHD, Govt. of India.
- Expert Committee to revisit the draft Standard Operating Procedures for import of SPF Broodstock of Crustaceans and Artemia from South East Asian countries, constituted by Coastal Aquaculture Authority.
- Expert Committee for verification of regulatory frameworks, infrastructure facilities and surveillance program, supply chain of shrimp and other crustaceans in South East Asian Countries, constituted by Department of Fisheries, MFAHD, Govt. of India.
- Fisheries Technology, Advisory, Development and Management Committee (Fish Tech Committee), constituted by Tamil Nadu Dr. J. Jayalalitha Fisheries University.
- Technical Committee constituted to oversee and monitor the functioning of the Aquatic Quarantine Facility (AQF), constituted by Coastal Aquaculture Authority.
- Committee on Fixation of Fee in respect of Affiliated colleges of Tamil Nadu Agricultural University.
- Chairman - Expert Committee to re-visit the draft Standard Operating Procedures (SOP) and criteria for the empanelment of suppliers for import of SPF shrimp and scampi broodstock, Parent Post Larvae (PPL) of crustacean along with *Artemia* cysts from Acute Hepatopancreatic Necrosis Disease (AHPND) affected countries, constituted by Coastal Aquaculture Authority.

Dr. Shashi Shekhar, Principal Scientist

- Nominated as Member of the Selection Committee for Career Advancement Scheme – 2025, in Tamil Nadu Veterinary and Animal Sciences University, Chennai.
- Nominated as Member-Secretary- Quinquennial Review Team (QRT)
- Nominated as Organizing Secretary: 12th Symposium on Diseases in Asian Aquaculture (DAA'12), Chennai, 23-27 September, 2025.

Dr. M. Poornima, Principal Scientist

- Served as centre coordinator for Combined National Eligibility Test (Net), Agricultural Research Service (ARS), Subject Matter Specialist (SMA) (T-6) & Senior Technical Officer (STO) (T-6) Examination – 2025 conducted during 2-4 September, 2025
- Served as reviewer for Trends in Sciences (TiS) and

American Journal of Animal and Veterinary Sciences

Dr. Vinaya Kumar Katneni, Principal Scientist

- Participated in expert consultation on development of a roadmap for translational genomics in Indian aquaculture", 29th August, 2025, ICAR-NBFGR, Lucknow.

Dr. P. Ezhil Praveena, Principal Scientist

- Member of TANUVAS Research Council in the category of specialists of eminence.
- External Member, Institute biosafety Committee (IBSC) of Madras veterinary College, Chennai.
- External Member in the Internal Complaints Committee of ICAR – NRC Banana, Tiruchirappalli.

Dr. R. Ananda Raja, Principal Scientist

- National Accreditation Board for Testing and Calibration Laboratories (NABL) assessor.
- Committee for Control and Supervision of Experiments on Animals (CCSEA) nominee to the Institutional Animal Ethics Committee (IAEC) .
- Editorial Advisory Board Member- Aquaculture
- Coordinator of Ministry of Micro Small and Medium Enterprises (MSME) sponsored Entrepreneurship Skill Development Programme (ESDP)- From Seed to Harvest: Hands on Training in Mud Crab Aquaculture held from 10-15 March, 2025.
- Member, Committee on National Traceability Framework.
- Member of committee for inspection of shrimp / fish hatcheries.

Dr. Sujeet Kumar, Principal Scientist

- Inspected 10 shrimp hatcheries located in Krishna and Bapatla districts of Andhra Pradesh hatcheries for registration and renewal at Bapatla and Krishna districts in Andhra Pradesh 13/03/2025.

Dr. Riteshkumar Shantilal Tandel, Senior Scientist

- Member of Planning Board of Kamdhenu University.
- Member of Scientific Advisory committee of college of Fisheries, Kamdhenu university, Navsari.
- Member of CAA for inspection of hatcheries of Gujarat .
- Member of SHAPHARI Certification committee of MPEDA for Gap audit and Certification audit of shrimp farms and hatcheries in Gujarat.
- Editorial Committee member: Aquaculture Nutrition and Aquaculture Research.

Dr. Pragyan Dash, Senior Scientist

- Editorial Committee member**:** Journal of Applied Ichthyology.

Shri. Jose Antony, Scientist

- Principal member of BIS Sectional Committee, TXD 18, Textile Materials for Marine/Fishing Purposes.
- Member of SHAPHARI Certification committee of MPEDA for Gap audit and Certification audit of shrimp farms and hatcheries in Gujarat.

Shri. Pankaj Amrut Patil, Scientist

- Member of Gujarat aquaculture development committee.

Swachh Bharat Activities

Honourable Prime Minister of India, on August 15, 2014, gave a call for Swachhata to become a national priority, and subsequently the Swachh Bharat Mission was launched on 2nd October 2014 under a 'Whole of Government' approach, making sanitation 'everyone's business'. To offer tribute to the Mahatma on his Jayanti, 2nd October is observed as Swachh Bharat Diwas. As a prelude to that, to strengthen voluntarism and collective action for Swachh Bharat, a fortnight of 'Swachhata Hi Seva' (SHS) has been observed since 2017. Over the past decade, the Central Institute of Brackishwater Aquaculture, with its headquarters at Chennai and the Research Centres NGRC, KRC, West Bengal, and two field stations MES & KES, has chalked out elaborate plans to carry out the National Sanitation Campaign. During the current year, ICAR-CIBA organized "Swachhta Pakhwada" from 16th to 31st December, 2025, including Kisan Diwas on 23rd December, 2025.

Beach cleaning programme

Bharat Diwas. As a prelude to that, to strengthen voluntarism and collective action for Swachh Bharat, a fortnight of 'Swachhata Hi Seva' (SHS) has been observed since 2017. Over the past decade, the Central Institute of Brackishwater Aquaculture, with

Honourable Prime Minister of India, on August 15, 2014, gave a call for Swachhata to become a national priority, and subsequently the Swachh Bharat Mission was launched on 2nd October 2014 under a 'Whole of Government' approach,

its headquarters at Chennai and two Research Centres, NGRC, Gujarat, and KRC, West Bengal, and two field stations, MES & KES, has chalked out elaborate plans to carry out the National Sanitation Campaign. During the current year, ICAR-CIBA

organized “Swachhta Pakhwada” from 16th to 31st December, 2025, including Kisan Diwas on 23rd December, 2025.

Swachhta Pakhwada was successfully organized at ICAR-CIBA, with active participation from all staff members, including Scientific, Administrative, Technical, YPs, and Research Scholars, emphasizing cleanliness, sustainability, and community engagement throughout the fortnight. The “Swachhta Pledge” was taken by the Scientists, Officers, Staff, and Students administered by Dr. Kuldeep K. Lal, Director, ICAR-CIBA. The regional centres KRC, and NGRC of ICAR-CIBA joined online for the pledge. Swachhta Awareness and a seminar on “Waste to Wealth” were conducted in ICAR-CIBA. The seminar highlighted productive ways to convert waste materials into useful products, promoting sustainable practices in daily life. A major focus of the campaign was the weeding out of old files, where obsolete and redundant records were systematically identified and removed, ensuring efficient space utilization and better document management. Cleanliness and sanitation drives were conducted. The cleanliness and sanitation drive in the office premises ensured dusting, cleaning of workstations, proper disposal of waste, and maintenance of hygienic conditions for all employees. In support of environmental conservation, a tree plantation drive was carried out with staff members planting saplings within the office compound, contributing to a greener and cleaner environment. For community involvement and to encourage creative expression, a drawing competition at NGRC was organized with themes centered on cleanliness and environmental protection, engaging participants of all ages.

In continuation of the sustainability theme, a seminar on the “recycling of wastewater” was held to educate participants about technologies and practices for water conservation and reuse. The Pakhwada concluded with an impactful sea beach cleaning programme at MES, where volunteers gathered to remove litter and raise awareness about marine pollution, reinforcing the message of protecting natural resources. Selfie booth photos were taken to encourage participation and posted on the CIBA website. The series of events marking Swachhta Pakhwada was featured in a vibrant presentation on the CIBA website and shared on social media to amplify awareness and participation. Overall, the Swachhta Pakhwada activities successfully fostered a spirit of cleanliness, environmental responsibility, and community participation across the office and beyond.

Tree plantation

Weeding out of old files

Mera Gaon Mera Gaurav

The Mera Gaon Mera Gaurav programme is implemented in twelve villages of Tamil Nadu by five multidisciplinary teams of scientists. These teams regularly visit the villages to create awareness about the brackishwater aquaculture technologies and other improved techniques. The activities constitute conduct of frontline demonstrations on sustainable livelihood models, technology, and dissemination of information on package of practices in brackishwater aquaculture species. The farmer has fully endorsed the services rendered by the ICAR-CIBA scientists by visualizing the improvement in the health of the shrimps/fishes/crabs, reduction in mortality rate, and low input costs of rearing by avoiding the unnecessary use of inputs. Besides brackishwater technologies, the scientists are facilitating information flow of fisheries development schemes launched by the Government of India for the overall development of the rural masses.

Area of activities

1. **Technical guidance to farmers**

   Selection of quality seed/fry

   Use of organic manure and inorganic fertilisers

   Crop diversification

   Adoption of climate-resilient and sustainable practices.

2. **Regular Communication and advisories**

   Personal village visits by a scientist

   Mobile messages (SMS/WhatsApp)

   Information through the community/AIR

   Seasonal farming guidance

3. **Demonstrations and farmers' meetings**

   Demonstration of location-specific sustainable livelihood modules

   Exposure to improved practices

4. **Awareness of social initiatives**

   Swachh Bharat programmes

   Soil health management

   Awareness of local issues

Viksit Krishi Sankalp Abhiyan

ICAR-CIBA actively participated in the Viksit Krishi Sankalp Abhiyan 2025-26 in association with KVKs of Tamil Nadu and Puducherry, Directorates of Extension TNAU Coimbatore, TANUVAS, Chennai and TNJFU, Nagapattinam, and ICAR-ATARI, Hyderabad, from 29th May 2025 to 12th June 2025. The objective of VKSA is to have knowledge synchronization and coordination between ICAR Institutes, Krishi Vigyan Kendras, and the Department of Agriculture of states to provide technological backstopping for the farmers for the kharif season 2025. ICAR-CIBA has deputed about 50 scientists and technical Officers in 450 villages in 10 districts of Tamil Nadu and Puducherry for this mega event proposed by Honourable Union Minister for Agriculture and Farmers Welfare and Ministry of Rural Development, Government of India, Shri Shivraj Singh Chouhan. During the campaign, all the inter-disciplinary team members visited the villages and created awareness among the farmers on the latest technologies for the kharif season in crop husbandry, animal husbandry, poultry, fisheries, and also sensitized them on various development schemes of the Government of India and the Government of Tamil Nadu and Puducherry in agriculture and its allied sectors

A convergence meeting cum interaction was conducted on 10th June 2025, in Villiambakkam, Pallur, Chengalpattu district of Tamil Nadu, in which about 379 farmers and other dignitaries from ICAR, New Delhi, Ministry of Agriculture and Farmers Welfare, GOI, New Delhi, ICAR ATARI Hyderabad, TANUVAS, Chennai, TNAU

Coimbatore, KVKs Chengalpattu, Tiruvallur, and Vellore participated. Dr. A. K. Nayak, DDG- NRM, ICAR, and Chief Nodal Officer for VKSA campaign for Zone-X comprising Tamil Nadu, Puducherry, Andhra Pradesh, and Telangana, in his address, expressed that ICAR institutes and KVKs need to work together to solve the field-level issues of the farmers. Dr. A. Velmurugan, ADG (SWCE), ICAR, New Delhi, opined that farmers need to be open and accept the ground realities for arriving at practical solutions for their technology related problems. Dr. Kuldeep K. Lal, Director, ICAR-CIBA and State Nodal Officer VKSA campaign for Tamil Nadu and Puducherry, stated that ICAR - CIBA's products: Planton^{Plus} and Horti^{Plus}, developed from fish waste, have been found to improve the productivity of paddy and horticultural crops. ICAR-CIBA can extend this technology to KVKs for wider dissemination among the farming and fisher communities.

Mrs. Deborah Initha, Joint Secretary, Ministry of Agriculture and Farmers Welfare, GOI, New Delhi, and Dr. Naveen Patle, Additional Commissioner, Ministry of Agriculture and Farmers Welfare, GOI, New Delhi, interacted with farmers and noted down the field level constraints being faced by them. Shortage of labour, timely availability of critical farm inputs like seeds and fertilizers, and various benefits from Central and State Government Schemes are some of the major issues which they are facing need to be solved. Dr. A. Bhaskaran, Principal Scientist, ICAR ATARI, Hyderabad, expressed that the diversified problems of the farmers will be solved on a priority basis by the KVKs and Development Departments. Earlier, Dr. V. Appa Rao, Director, Extension Education, TANUVAS, Chennai welcomed the gathering and stated that KVKs in Tamil Nadu and Puducherry will provide all required technological backstopping to the farming community.

Gender Research and Extension

Gender Policy and Strategy

The ICAR Gender Strategy focuses on mainstreaming gender in research, education, and extension. ICAR-CIBA, along with its regional centres, implements initiatives to enhance women's participation and empowerment.

Research and educational activities:

- Integration of gender perspectives in aquaculture research with participatory involvement of women in trials and validation.
- Gender sensitization through awareness,training, seminars, and capacity-building programmes promoting entrepreneurship.
- Collection of gender-disaggregated data for monitoring participation and livelihood outcomes.
- Development of women-friendly technologies (seabass nursery rearing, ornamental fish culture, seaweed farming, integrated farming, value addition).
- Active involvement of women in culture operations, post-harvest, and marketing.
- Training on climate-smart practices for resilience and livelihood security.

Extension and outreach activities:

- Organization of programmes (Mera Gaon Mera Gaurav, Fish Farmers' Day, Women's Day, Kisan Diwas, etc.) with women's participation.
- Outreach on shrimp disease management and farmer–scientist interactions.
- Technology demonstrations based on farmers' needs.
- Promotion of sustainable aquaculture under SCSP and TSP with women beneficiaries.

Capacity building & skill Development:

- Training in stocking, grading, feed management, water quality, hapa management, and ornamental fish culture.
- Hands-on training for women, youth, and entrepreneurs.

Digital & social awareness:

- Use of mass media (Doordarshan, All India Radio, live programmes) for knowledge dissemination.
- Live streaming of events and use of institutional digital platforms.

Student involvement:

- Awareness,training, exposure visits, and field learning for women students and entrepreneurs.
- Participation in areas like shrimp insurance, ornamental fish culture, disease awareness, epidemiology, and sanitation drives.

Institutional support & ender Mainstreaming:

- Viksit Bharat initiatives promote skills, livelihoods, and self-reliance.
- Collaboration with departments, ICAR institutes, NGOs, and stakeholders.
- Implementation of SHGs, SCSP, and TSP-based livelihood models.
- Contribution to gender-responsive research and reporting.

Conclusion:

ICAR-CIBA aligns with ICAR Gender Strategy 2025 by promoting inclusive programmes, strengthening women's skills and entrepreneurship, supporting capacity building, engaging youth, and enhancing self-employment and income generation.

Distinguished Visitors

Sl. No.	Details of Visitors	Date of Visit
	ICAR-CIBA, HQ	
1.	Ms. D. Rishika, CEO of Nutricape Pvt Ltd	28th February 2025
2.	Ms. Scarlet Danielle Grey, Senior Associate, M/s. Anand and Anand, Patent Firm, Chennai	1st May 2025
3.	Shri K.C. Devasenapathi, IAS, Member-Secretary, Coastal Aquaculture Authority, Govt. of India	23rd June 2025
4.	Dr. Muthukumar Subramanian, Registrar and Dr. Susan Elias. Professor & Director Research, HIET	24th July 2025
5.	Dr. Anil K. Thakur, Professor, Mr. G. Dinesh Kumar, Assistant Professor (S.G) – ANRO and Dr. G. Muthukumaran, Professor – CENSE (HEAD), Hindustan Institute of Technology and Science, Chennai	24th July 2025
6.	Shri. George Kurian, Honourable Union Minister of State for Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying and Minority Affairs, Government of India	23-27th September 2025
7.	Dr. Joykrushna Jena, Deputy Director General (Fy.), ICAR, New Delhi	23-27th September 2025
8.	Dr. N. Subbaiyan, Secretary, Dept. of Animal Husbandry, Dairying, Fisheries & FW, Govt of TN	23-27th September 2025
9.	Dr. Kua Beng Chu, Chairperson, Asian Fisheries Society (FSH)	23-27th September 2025
10.	Dr. Bijay Kumar Behera, Chief Executive, NFDB	23-27th September 2025
11.	Shri. K.C. Devasenapathy, IAS, secretary, the Coastal Aquaculture Authority, Govt. of India	27th September 2025
12.	Prof. Kenton L. Morgan, an expert in the field of epidemiology and former emeritus Professor at University of Liverpool, United Kingdom	29th September to 3rd October 2025
	Kakdwip Research Centre	
13.	Dr. K. K. Satapathy, former director, ICAR-National Institute of Natural Fibre Engineering and Technology, Kolkata, West Bengal	9th December 2025
	Navsari Gujarat Research Centre	
14.	Shri. Mukesh Zinabhai Patel, Honourable Minister of Forest and Environment, Climate Change, Water Resources and Water Supply, Govt. of Gujarat,	21-23rd February, 2025

Personnel

Sl. No.	Name & Designation
1.	**Dr. Kuldeep K. Lal** Director

Scientists - HQ

2.	**Dr. C. P. Balasubramanian** Principal Scientist & Head, CCD (Superannuation on 31.7.2025)
3.	**Dr. M. Kailasam** Principal Scientist & Head, FCD
4.	**Dr. K. Ambasankar** Principal Scientist & Head, NGBD
5.	**Dr. M. Shashi Shekhar** Principal Scientist & Head, AAHED
6.	**Dr. C.V. Sairam** Principal Scientist
7.	**Dr. T. Ravisankar** Principal Scientist & SIC - SSD
8.	**Dr. M. Muralidhar** Principal Scientist
9.	**Dr. (Smt.) M. Jayanthi** Principal Scientist & Head i/c, CCD (w.e.f 1.8.2025)
10.	**Dr. (Smt.) B. Shanthi** Principal Scientist
11.	**Dr. (Smt.) D. Deboral Vimala** Principal Scientist
12.	**Dr. (Smt.) P. Nila Rekha** Principal Scientist
13.	**Dr. J. Syama Dayal** Principal Scientist
14.	**Dr. Akshya Panigrahi** Principal Scientist & SIC - NGRC
15.	**Dr. M. Kumaran** Principal Scientist
16.	**Dr. S. Kannappan** Principal Scientist (On Deputation w.e.f 2.6.2025)
17.	**Dr. (Smt.) M. Poornima** Principal Scientist
18.	**Dr. (Smt.) R. Saraswathy** Principal Scientist & OIC-Library
19.	**Dr. M. Makesh** Principal Scientist
20.	**Dr. (Smt.) Sherly Tomy** Principal Scientist
21.	**Dr. Prasanna Kumar Patil** Principal Scientist & OIC-ITMU & PME Cell
22.	**Dr. Subhendu Kumar Otta** Principal Scientist
23.	**Dr. R. Jayakumar** Principal Scientist & OIC-MES of CIBA
24.	**Dr. K.P. Kumaraguru Vasagam** Principal Scientist
25.	**Dr. (Smt.) P. Mahalakshmi** Principal Scientist & OIC-AKMU & Engineering Cell
26.	**Dr. T. Senthil Murugan** Principal Scientist
27.	**Dr. Vinaya Kumar Katneni** Principal Scientist
28.	**Dr. (Smt.) P. Ezhil Praveena** Principal Scientist
29.	**Dr. R. Ananda Raja** Principal Scientist
30.	**Dr. B. Sivamani** Principal Scientist
31.	**Dr. Sujeet Kumar** Principal Scientist (Promotion w.e.f 7.1.2024)
32.	**Dr. (Smt.) Shyne Anand** Principal Scientist (Promotion w.e.f 7.1.2024)
33.	**Dr. (Smt.) R. Geetha** Senior Scientist
34.	**Dr. P. Kumararaja** Senior Scientist
35.	**Dr. (Smt.) N. Lalitha** Senior Scientist
36.	**Dr. (Smt.) T. Bhuvaneswari** Senior Scientist
37.	**Dr. Ashok Kumar Jangam** Senior Scientist
38.	**Dr. K. Saravanan** Senior Scientist (Joined on 9.5.2025)
39.	**Dr. R. Subburaj** Senior Scientist (Joined on 21.5.2025)
40.	**Dr. Anindya Sundar Barman** Senior Scientist (Joined on 10.6.2025 & Relieved on 18.11.2025)
41.	**Dr. (Smt.) Vidya Rajendran** Senior Scientist
42.	**Dr. Aritra Bera** Senior Scientist
43.	**Dr. J. Raymond Jani Angel** Senior Scientist

Sl. No.	Name & Designation
44.	**Dr. T. Sathish Kumar** Senior Scientist (Promotion w.e.f 1.1.2024)
45.	**Dr. K. P. Sandeep** Senior Scientist (Promotion w.e.f 1.1.2024)
46.	**Dr. K. Anantharaja** Senior Scientist (Promotion w.e.f 1.1.2024)
47.	**Smt. Mary Lini** Scientist
48.	**Dr. T. Sivaramakrishnan** Scientist (Relieved on 8.5.2025 to join as Senior Scientist at ICAR–CIFA)
49.	**Shri C. Siva** Scientist
50.	**Shri Dani Thomas** Scientist
51.	**Shri R. Aravind** Scientist
52.	**Dr. N. S. Sudheer** Scientist (Transferred from KRC to Hqrs on 4.10.2025)
53.	**Dr. (Smt.) Sajina K.A.** Scientist (Joined on 27.10.2025)

Kakdwip Research Centre (KRC) of ICAR - CIBA, West Bengal

54.	**Dr. Debasis De** Principal Scientist & Head, KRC
55.	**Dr. Sanjoy Das** Principal Scientist
56.	**Dr. Sanjay Kumar Gupta** Senior Scientist (Joined on 15.2.2025)
57.	**Smt. Babita Mandal** Scientist
58.	**Shri Biju I.F.** Scientist
59.	**Smt. Misha Soman** Scientist
60.	**Dr. Moumita Ash** Scientist

Navsari – Gujarat Research Centre (NGRC) of ICAR - CIBA, Gujarat

61.	**Dr. Pareshkumar Himmatlal Rathod** Senior Scientist (Joined on 27.6.2025)

Sl. No.	Name & Designation
62.	**Dr. Ritesh Kumar Shantilal Tandel** Senior Scientist (Promotion w.e.f 1.1.2024)
63.	**Dr. (Smt.) Pragyan Dash** Senior Scientist (Promotion w.e.f 1.1.2024)
64.	**Shri Pankaj Amrut Patil** Scientist
65.	**Shri Jose Antony** Scientist
66.	**Dr. Amrutha Gopan** Scientist (Joined on 27.10.2025)

Technical - HQ

67.	**Dr. S. Sivagnanam** Chief Technical Officer (Superannuation on 28.2.2025)
68.	**Shri D. Raja Babu** Chief Technical Officer (Superannuation on 30.6.2025)
69.	**Shri S. Rajamanickam** Chief Technical Officer (Superannuation on 30.4.2025)
70.	**Dr. Joseph Sahayarajan** Chief Technical Officer
71.	**Shri S. Nagarajan** Chief Technical Officer (Promotion w.e.f 3.1.2024)
72.	**Dr. A. Nagavel** Chief Technical Officer (Promotion w.e.f 21.8.2024)
73.	**Shri N. Jagan Mohan Raj** Technical Officer
74.	**Shri D. M. Ramesh Babu** Technical Officer
75.	**Shri G. Thiagarajan** Technical Officer
76.	**Shri K. Karaiyan** Technical Officer (Promotion w.e.f 10.9.2022)
77.	**Shri S. Prabhu** Senior Technical Assistant (Promotion w.e.f 14.9.2023)
78.	**Shri K.V. Delli Rao** Technical Assistant
79.	**Shri C. Saravanan** Technician
80.	**Shri C. Ragu** Technician

Sl. No.	Name & Designation
81.	**Shri R. Indrakumar** Technician

Technical - KRC

82.	**Smt. Chhanda Mazumder** Technical Officer

Technical - NGRC

83.	**Shri M.D. Reyajuddin** Technician

Administration - HQ

84.	**Shri Navin Kumar Jha** Chief Administrative Officer
85.	**Smt. Komal Sheokand** Chief Finance & Accounts Officer (Promotion w.e.f. 1.1.2025)
86.	**Shri Aswin Haridas** Administrative Officer
87.	**Shri P. Srikanth** Finance & Accounts Officer (Promotion w.e.f. 28.4.2025)
88.	**Shri A. Sekar** Assistant Administrative Officer (Superannuation on 30.4.2025)
89.	**Smt. E. Mary Desouza** Assistant Administrative Officer
90.	**Shri Vinod Kumar. N** Assistant Finance & Accounts Officer
91.	**Smt. S. Nalini** Private Secretary
92.	**Smt. K. Hemalatha** Personal Assistant
93.	**Smt. K. Subhashini** Personal Assistant
94.	**Smt. R. Vetrichelvi** Assistant
95.	**Smt. M. Mathuramuthu Bala** Assistant
96.	**Shri Karthick S** Assistant
97.	**Ms. Jayasri R** Assistant
98.	**Shri Kushal Mukherjee** Assistant
99.	**Shri Anand S T** Assistant
100.	**Ms. Sambhavi J** Assistant

Sl. No.	Name & Designation
101.	**Shri Pradeep Biradar** Assistant (Relieved on 7.8.2025 to join ICAR-NIVEDI)
102.	**Shri Hinge Vishal Dattatray** Assistant (Relieved on 1.9.2025 to join ICAR-NRCP)
103.	**Smt. B. Prasanna Devi** Assistant (Promotion w.e.f. 1.1.2025)
104.	**Shri P. Abhishek** Assistant (Joined on 29.12.2025)
105.	**Shri Sanjeev Antony** Assistant (Joined on 31.12.2025)
106.	**Ms. Chava Tejahnavi** Assistant (Joined on 29.12.2025)
107.	**Shri R. Kumaresan** Upper Division Clerk
108	**Shri A. Paul Peter** Upper Division Clerk
109.	**Shri V. Kishorkumar** Lower Division Clerk
110.	**Shri S. Solin Igneshus** Lower Division Clerk

Administration - KRC

111.	**Shri Sanjoy Some** Lower Division Clerk

Skilled Support Staff - HQ

112.	**Shri S. Selvababu**
113.	**Shri P.G. Samuvel**
114.	**Shri M. Sakthivel**
115.	**Shri R. Mathivanan**
116.	**Shri G. Dayalan**
117.	**Shri Kanaka Prasad**
118.	**Shri J. Murugan**

Skilled Support Staff – KRC

119.	**Shri P. C. Das**

Infrastructure Development

Headquarters

Repair of internal roads

Repair and painting of Trainees' Hostel

Repair and painting of compound wall

Muttukadu Experimental Station

Restored shrimp culture lining ponds (4 Nos.)

Renovated shrimp quarantine building

Restored wall at hatchery entrance gate

Generator facility for hatchery

Kovalam Experimental Station

Construction of shrimp Nucleus breeding hatchery

Library and e-Resources

Library and Documentation

ICAR-Central Institute of Brackishwater Aquaculture possesses a full-fledged library and e-resource centre covering a rich collection of reference books and scientific journals in aquaculture, physiology, nutrition, aquatic animal health, environmental sciences, biotechnology, genetics, bioinformatics, socio-economics, and extension education. The library caters to the information needs of scientists, research scholars, scientific personnel of other research organisations, academicians, university students, and various stakeholders associated with the fisheries and aquaculture sector.

Library Resources

ICAR-CIBA library has a rich collection comprising around 3,184 reference books, 1,631 journal back volumes, 7,015 journal issues, 4,895 abstracts, newsletters and reports, 150 Ph.D. theses, and 2,712 other publications. The collection is continuously expanding each year through the addition of new books and subscriptions to national and international journals. ICAR-CIBA is registered to One Nation One Subscription (ONOS) to provide centralized, nation-wide access to top-tier scientific journals and research databases. It can be accessed online by scientists at the headquarters and research centres at Kakdwip and Navasari. CIBA has also subscribed to the anti-plagiarism software iThenticate to support researchers in publishing high-quality research papers in reputed journals.

Automation

The ICAR - CIBA library is fully automated on the KOHA library management system platform with various features. The Online Public Access Catalogue (OPAC) module has been activated, which provides a simple and clear interface for searching books, journals, and other documents in the library.

Library and e-Resource Centre

ICAR - CIBA library has been upgraded as the Library and e-Resource Centre to access e-books, online journals, Institute publications, and scientists' publications for easy retrieval and use by scientists and scholars.

Data Repository

The ICAR - CIBA digital library system has been established to manage library holdings and maintain records. The system provides an inventory of books available in the library and the Institute publications. It is programmed to monitor the lending of books, and scientists can identify the books required for purchase within the same portal.

Exchange Services

ICAR - CIBA library maintains regular exchange services with national and international organisations of mutual interest in the sector. Institute's annual reports, newsletters, and other research publications are being sent to various research organizations, universities, and other stakeholders to familiarise the Institute's research and development programmes. The library also receives similar services from other organizations.

Utilization of Funds

The funds allotted to the library were effectively utilized to procure referral books and journals for the scientists and staff of Headquarters, KRC, and NGRC.

Library Holdings

Publications/ Oral Presentations

Peer Reviewed Articles

1. **Abraham, T. J., Bora, M., Bardhan, A., Sen, A., Das, R., Nadella, R. K., & Patil, P. K.** (2025). In-feed oxolinic acid induces oxidative stress and histopathological alterations in Nile tilapia *Oreochromis niloticus*. Toxicology Reports, 14, 102020.

2. **Abraham, T. J., Roy, A., Singha, J., & Patil, P. K. (**2025). Histoarchitectural changes in the vital organs of *Oreochromis niloticus* fry administered therapeutic, and overdoses of dietary oxytetracycline. Archives of Ecotoxicology, 7(1): 1-10

3. **Abraham, T. J., Roy, A., Singha, J., Rajisha, R., Nadella, R. K., & Patil, P. K.** (2025). Muscle biochemistry and residue accretion in male *Oreochromis niloticus* fries administered therapeutic, subtherapeutic and overdoses of dietary oxytetracycline. Fish Physiology and Biochemistry, 51(1), 35.

4. **Abraham, T. J., Singha, J., Dash, G., Nagesh, T. S., Karmakar, S., & Patil, P. K.** (2025). Influence of infeed emamectin benzoate and winter on the bioresponses of *Oreochromis niloticus*. Academia Biology, 3(1).

5. **Barlaya, G., Anantharaja. K., C. Huchchappa, R., B. Sriramreddy, A. K., Saurabh, S., & Kannur, H.** (2025). Effect of dietary lipid levels on growth, nutrient digestibility and digestive enzyme activity of the peninsular carp *Hypselobarbus pulchellus* (Day, 1870). Indian Journal of Fisheries, 72(2): 94-102.

6. **Bhargavi, K. S. S., Kumaran, M., Ravisankar, T., Kumar, J. A., Kumar, T. S., Muralidhar, M., Elakkiya, N., & S, A. P.** (2025). Is the price volatility risk in shrimp farming manageable and can profitability be sustained? Aquaculture International, 33(1), 57.

7. **Bhargavi, K.S.S., Kumaran, M., Muralidhar, M., Kumar, C., Kumar, T. S., Ravisankar, T., & Ananthan. P.S.** (2025). Does abiotic stress influence the white fecal disease incidence and its intensity in *Penaeus vannamei* shrimp farms? Aquaculture International, 33:220.

8. **Bhuvaragavan, S., Sruthi, K., Panigrahi, A., & Janarthanan, S.** (2025). Microbiome of different gut compartments of banana pseudostem weevil *Odoiporus longicollis* (Coleoptera: Curculionidae) offers an understanding of site-specific diversity and metabolism: Whole-metagenome shotgun sequencing approach. Ecological Genetics and Genomics, 36, 100397.

9. **Chitra, V., Saraswathy, R., & Muralidhar, M.** (2025). Revisiting the estimation procedures in lime requirement for aquaculture pond soils, EJPMR, 12(3), 257-261

10. **Das, R., Abraham, T. J., Sen, A., Rajisha, R., Nadella, R. K., & Patil, P. K.** (2026). Withdrawal period and elimination half-life of enrofloxacin, with assessment of its impact on bioresponses of *Oreochromis niloticus* according to integrated biomarker response. Environmental Toxicology and Chemistry, 45(4), 873–889.

11. **Das, R., Abraham, T. J., Sen, A., Rajisha, R., Nadella, R. K., Chatterjee, N. S., & Patil, P. K.** (2025). Impact of graded doses of enrofloxacin on the safety and biological responses of Nile tilapia *Oreochromis niloticus*. Drug and Chemical Toxicology, 48(4), 784–796.

12. **Dheeran, P., Anantharaja, K., Campal, E.I., Kara, T., Selvaraj, M., Arisekar, U., Assiri, M.A. & Iswarya, K.** (2025). Harnessing Biofloc Technology: A Sustainable Paradigm for Modern Aquaculture—A Review. Annals of Animal Science, 25(4), 1387-1401

13. **Francis, B., Balasubramanian, C.P., Anand, P.S., Panigrahi, A., Antony, J., Sudheer N.S., Aravind, R., & Vijayan, K.K.** (2026). Effect of rearing environment and age on spermatophore quality in *Penaeus indicus* and validation of short-term storage extenders, Animal Reproduction Science, 287, 108114.

14. **Geetha, R., Abhinaya, D., Gowsar, S.N., Ravisankar, T., Kailasam, M., Jayakumar, R., Subburaj, R., Shinoj, P., Jain, L.R., Lal, K. K & Patil, P. K.** (2025). Aquaculture of Asian seabass (*Lates calcarifer*) in India: A comparative economic analysis across production systems and regions. Aquaculture International, 33, 585.

15. **Griboff, J., Carrizo, J. C., Bacchetta, C., Rossi, A., Wunderlin, D. A., Cazenave, J., & Amé, M. V.** (2025). Effects of short-term dietary oxytetracycline treatment in the farmed fish *Piaractus mesopotamicus*. Environmental Toxicology and Chemistry, 44(5), 1289–1296.

16. **Hussain, T., Kailasam, M., Kumar, P., Verma, A. K., Dayal, S. J., Krishnani, K. K., Mahesh, V., & Sarma, D.** (2025). Reproductive biology of fourfinger threadfin, *Eleutheronema tetradactylum* (Polynemidae) from north-eastern Arabian Sea. Indian Journal of Fisheries, 72(2), 33–44.

17. **Hussain, T., Kailasam, M., Kumar, P., Verma, A. K., Mahesh, V., Ramudu, K. R., Harijan, T. V., & Sarma, D.** (2025). Histological observations on oocyte development in the fourfinger threadfin (*Eleutheronema tetradactylum*). Indian Journal of Animal Research, 1-7.

18. **Italiya, J. V., Kalasariya, R. L., Chawla, S., Rathod, P. H., & Acharya, R. R.** (2025). Dissipation of six insecticides and evaluation of their processing factors in different chilli samples. J. Consum. Prot. Food Saf., 20(4), 393–405.

19. **Kaikkolante, N., Katneni, V. K., Palliyath, G. K., Jangam, A. K., Dayal, J.S,, Krishnan, K., Prabhudas, S.K. & Shekhar, M.S.,** (2025). Computational insights into host–pathogen protein interactions: unveiling penaeid shrimp and white spot syndrome virus interplay. Mol Genet Genomics 300, 35.

20. **Kotakonda, M., & Marappan, M.** (2025). The Antibacterial Efficacy of a compound extracted from marine sediment bacterium *Enterococcus lactis* (S-2): A comparative analysis through *in-vitro* and *in-silico* assessments. Current Computer-Aided Drug Design, 21(7), 972–983.

21. **Krishnani, K. K., Kailasam, M., Brahmane, M. P., Das, B. K., Sukhdhane, K., Panigrahi, A., Bera, A., & Ezhil, P.** (2025). Unveiling the effect of stocking density and salinity on mucus-associated greenwater qualities, physiology, and growth performance of euryhaline milkfish *Chanos Chanos*. Agricultural Research, 14(4), 868-880.

22. **Krishnaswamy, S., Yashpal., Panigrahi, P., Panigrahi, A., & Nagarajan, G. S.** (2025). Investigation of the optical properties of Dy doped ZnO/PVA thin film: White light emission for LED application, Results in Optics, 18,100786,

23. **Kumar, T. S., Rajeshwar, B. N., Sivaramakrishnan, T., Kumar, S., Rajendran, V., Kumar, S., Pineda, L., Rezvani, M. & Saravanan, S.** (2025). Evaluation of a synergistic blend of short-and medium-chain fatty acids as a dietary intervention for the effective management of Vibriosis in shrimp culture. Fish & Shellfish Immunology, 157, 110098.

24. **Kumar, T. S., Sivaramakrishnan, T., Rajeshwar, B. N., Praveena, P. E., Ambasankar, K., Jithendran, K. P., Shekhar, M. S., & Lal, K. K.** (2025). Efficacy of 'CIBA EHP Cura l'in the control and treatment of *Ecytonucleospora hepatopenaei* in shrimp culture. Aquaculture, 612, 743231.

25. **Kumaran, M., Kumaraguruvasagam, K. P., Ravisankar, T., Panigrah, A., Ramachandran, K., Suresh, A., Kannadasan, S., & Sushmitha Bhargavi, K. S.** (2025). Does integration of on-farm nursery as pre-grow out phase facilitate smart shrimp farming? Aquaculture International, 33(6), 426.

26. **Kumararaja, P., Muralidhar, M., Saraswathy, R. & Nagvel, A.** (2026). Phosphorous adsorption by biochar synthesised from aquaculture pond sludge. Poll. Res. 45, 106–111.

27. **Lalitha, N., Katneni, V. K., Jangam, A. K., Suganya, P. N., Sukumaran, S., & Muralidhar, M.** (2025). Insight into the bacterial communities in the sediment–water interface across different salinities of Pacific White shrimp,

Penaeus vannamei, by metabarcoding. Letters in Applied Microbiology, 78 (2), ovaf020.

28. **Madhubabu, E. P., Jannathulla, R., Khan, H. I., Thoufeek, Y. M., Ambasankar, K., & Dayal, J. S.** (2025). Combined plant proteins as fishmeal replacements in pearlspot (*Etroplus suratensis*): Effects on growth performance, digestive enzymes and fatty acid composition. Indian journal of fisheries, 72(3), 102–109.

29. **Mallik, S.K., Pathak, R., Kala, K., Patil, P.K., Shahi, N., Tandel, R.S., Chatterjee, N.S., Nadella, R.K. & Kunal, K.** (2025). Pharmacokinetics of praziquantel in rainbow trout, *Oncorhynchus mykiss* (Walbaum 1792) following a single dose oral administration. Veterinary Research Communications, 49(6), 341

30. **Meenakshisundaram, M., Mboya, J. B., Sugantham, F., Panigrahi, A., Gamba, J. L., Subramanian, S., Chia, S. Y., Beesigamukama, D., Munguti, J., Ogello, E., Yossa, R., & Tanga, C. M.** (2025). Synergistic microbial interactions between algae and bacteria augment growth and immune performance in Red tilapia (*Oreochromis* sp.). Aquaculture Journal, 5(3), 12.

31. **Ojugan, T. S., P., E., Thomas, D., Bera, A., Angel, J. R. J., Thiagarajan, G., Kailasam, M., & Lal, K. K.** (2025). Advancing captive maturation and spawning through induced breeding trials in goldlined seabream *Rhabdosargus sarba* (Forsskål, 1775). Aquaculture International, 33(3), 203.

32. **Nagendrasai, K., Krishnani, K.K., Verma, A.K., Sarkar, D.J., Patil, P.A., Poojary, N., Sharma, A., Mahto, G., & Tripathi, G.** (2025). Acute toxicity and safe level of hexavalent chromium to euryhaline Milkfish in freshwater synergising with morphological, behavioural and histological indices. Bulletin of Environmental Contamination and Toxicology, 116, 18.

33. **Palliyath, G. K., Jangam, A. K., Katneni, V. K., Kaikkolante, N., Panjan Nathamuni, S., Jayaraman, R., Jagabattula, S., Moturi, M., & Shekhar, M. S.** (2025). Meta-analysis to unravel core transcriptomic responses in *Penaeus vannamei* exposed to biotic and abiotic stresses. Biochemical Genetics, 63(2), 1459–1478.

34. **Panigrahi, P., PS, A., Pal, Y., Sharma, M., Bae, H., Lee, H., Wilson, S.C., Panigrahi, A., Kotmool, K. & Hussain, T.** (2025). WS2 Nanosheet-Based Sensors for Efficient Detection and Removal of Potentially Toxic Elements: A DFT Investigation. ACS Applied Nano Materials, 8 (31), 15547-15557.

35. **Panigrahi, P., Srinivasan, U., Sharma, M., Bae, H., Lee, H., Panigrahi, A., & Hussain, T.** (2025). Detecting specific volatile organic compounds in aquaculture monitoring using tungsten diselenide monolayers, Materials Today Chemistry, 45, 102656.

36. **Parmar, K. D., Rathod, P. H., Kalasariya, R. L., Pandya, M. J., Patel, M. R., Chawla, S., & Patel, M. P.** (2025). Dissipation and risk assessment of a combination product of chlorantraniliprole + abamectin and spirotetramat in pomegranate fruit and juice. Biomedical Chromatography, 39 (9), e70174.

37. **Patel, A. J., Patel, H. K., Rathod, P. H., Raval, C. H., Parmar, D. K., Chavda, K., & Kurkutiya, S. R.** (2025). Split application of nitrogen: A strategy for improving fodder yield and quality in Kharif sorghum. Plant Science Today, 12 (sp4), 1–9.

38. **Pathak, R., Mallik, S. K., Patil, P. K., Shahi, N., Kala, K., Bhat, R. A. H., Nadella, R. K., Pandey, N., & Pandey, P. K.** (2025). Assessment of single-dose pharmacokinetics of oxolinic acid in Rainbow trout and determination of in vitro antibacterial activity against pathogenic bacteria from diseased fish. Journal of Veterinary Pharmacology and Therapeutics, 48(1), 44–55.

39. **Ravisankar, T., Patil, P.K., Geetha, R., Sairam, C.V., Kumaran, M., Muralidhar, M., Ananda Raja, R., Kavibharathi, S.M., Testimona, A., Podili, V. & Lal, K. K.** (2025). Transforming risk into resilience: A review of insurance strategies for sustainable shrimp aquaculture in India and beyond. Frontiers in Sustainable Food Systems, 9, 1663329.

40. **Patil, P. K., Geetha, R., Mishra, S.S., Abraham, T.J., Solanki, H.G., Sharma, K., S.R., Pradhan, P.K., Manna, S.K., Avunje, S., Abhinaya, D. & Felix, K.T.** (2025). Unveiling the economic burden of diseases in aquatic animal food production in India. Frontiers in Sustainable Food Systems, 9, 1480094.

41. **Patil, P.A., Hussain, T., Ambasankar, K., Kailasam, M., & P. Mahalakshmi, P.** (2025). Growth performance and feed utilization of grey mullet fingerlings fed with varying levels of protein during nursery rearing phase. Journal of Environmental Biology., 46, 652-658.

42. **Praveena, P. E., Swain, S., Allie, N. U., Kathirkaman, V., Kannan, S., Balagopal, K. B., Shreelekha, M.P., Bhuvaneswari, T., Lal, K.K. & Otta, S.K.** (2025). Widespread detection of Wenzhou shrimp virus 8 (WzSV8) and its implication in cultured shrimp (*Penaeus vannamei*) farms of India. Journal of Invertebrate Pathology, 213, 108412.

43. **Prasanth, S. R., Senthamizh, T. K., Shekhar, S., Gnanappazham, L., & Prasad, K. A.** (2025). Analysing the spatiotemporal dynamics of coastal aquaculture along the northern coastal plains of Tamil Nadu, India, using remote sensing time series data. Aquaculture International, 33(6), 590.

44. **Radhakrishnan, N., Panigrahi, A., Rajeshwar, B. N., & Bedekar, M.K.** (2026). Shrimp immune responses and antimicrobial peptides: an overview with emphasis on Vibrio infection. Aquaculture International 34, 78.

45. **Rai, N., Julka, J. M., Panigrahi, A., & Das, S. P.** (2025). Synergistic carbon source utilization in Biofloc aquaculture of common carp (*Cyprinus carpio*): impacts on growth, health, and environmental parameters. Frontiers in Marine Science, 12, 1576079.

46. **Rai, N., Kachore, A., Julka, J. M., Panigrahi, A., Das, S. P., & Nan, F. H.** (2025). Symbiotic strategies: deciphering the role of gut microbiota in the nutrition and metabolism of fish and shellfish. Frontiers in Cellular and Infection Microbiology, 15, 1639426.

47. **Raj, V. M., Thirunavukkarasu, A. R., Kailasam, M., Subburaj, R., & Thiagarajan, G.** (2025). A study on cadmium accumulation in the fingerlings of Asian seabass *Lates calcarifer* (Bloch). Asian Journal of Current Research, 10(3), 1–9.

48. **Raja, N. R., Peter, N. R., Rengarajan, J., Radhakrishnan, A., Saravanan, A. K., Kondusamy, A., & Paran, B. C.** (2024). Spatial modelling of seaweed farming potential areas in Chengalpattu district using a Fuzzy AHP-GIS framework. Indian Journal of Geo-Marine Sciences (IJMS), 53(05), 322–337.

49. **Raja, R.N., Rekha, P.N., Aravind, R., Kumar, S.A., Jayakumar, R., Ambasankar, K., & Balasubramanian, C.P.** (2025). Culture potential of *Gracilaria salicornia* in the brackishwater ecosystem: A multifaceted approach towards sustainable development goals. Blue Biotechnology, 2(1), 9.

50. **Rathod, S. K., Devi, M. S., Bera, A. K., Mishra, S., Das, B. K., Tandel, R. S., & Manna, S. K.** (2025). Abiotic stressors influence saprolegniasis infection, causing mass mortality in *Pangasianodon hypophthalmus* and *Labeo rohita* under cage culture in Eastern India. International Microbiology, 28(8), 2739–2748.

51. **Riyaz, R., Dash, P., Kunal, K., Tandel, R., Sawant, P. B., & Sarma, D. (**2025). Reproductive biology, histomorphometry and annual maturation cycle of *Barilius vagra* in Ladhia river, a mid-altitudinal Himalayan lotic ecosystem of Uttarakhand, India. Journal of Environmental Biology, 46(2), 177–187.

52. **Sandeep, K. P., De, D., Angel, J. R. J., Sivaramakrishnan, T., Ananda Raja, R., Thomas, D., Mahalakshmi, P., Ambasankar, K., Kailasam, M., & Lal, K. K.** (2025). Biowaste to Biomass: Fish waste hydrolysate enhances growth and health of Pearlspot, *Etroplus Suratensis* in a brackishwater culture system. Waste and Biomass Valorization, 1-16.

53. **Sandeep, K. P., De, D., Raja, R. A., Sivaramakrishnan, T., Kumar, S., Angel, J. R. J., Suvana, S., Mahalakshmi, P., Ambasankar, K., & Vijayan, K. K.** (2025). Assessing the influence

of fish waste hydrolysate, a byproduct of fish post-harvest, processing and fish markets, on the production performance of *Penaeus monodon* across diverse culture systems. Aquaculture International, 33(3), 231.

54. **Saraswathy, R., Mahalakshmi, P., Aravind, R., Jayanthi, M., Gopinath, D., Rajesh, R., Avunje, S., Kumararaja, P., & Muralidhar, M.** (2025). Assessment of suitability of a rejuvenated creek in the urban area for cage aquaculture using multi-criteria decision support analysis - A case study from South-East Coast of India. Indian Journal of Fisheries, 72(1), 77-86.

55. **Saravanan, K., Rathinam, R. B., Iburahim, S. A., Praveenraj, J., Kiruba-Sankar, R., & Kumar, G.** (2025). Dissection of emerging shrimp viruses through scientometric assessment: Insights into Infectious Myonecrosis Virus (IMNV) and Decapod Iridescent Virus 1 (DIV1). Viruses, 17(8), 1115.

56. **Sathish Kumar, T., Suvetha, S., Rajeshwar, B. N., Makesh, M., Shekhar, M. S., & Lal, K. K.** (2025). Portable DNA extraction and loop-mediated isothermal amplification (LAMP) for the on-site detection of white spot syndrome virus (WSSV). Aquaculture, 596, 741760.

57. **Shaik, H., Sharma, A., Badekar, M. K., Kumar, S., Konduri, A., Mathew, M., Chandru, G., Nadella, R. K., Ravindran, R., Chatterjee, N. S., Kuricheti, P.P. and Patil, P. K.** (2025). Evaluating the Lethal Dose (LD50) of ivermectin for Common carp: Insights from an oral toxicity study. Journal of AOAC International, 108(5), 661–669.

58. **Sharon, J., Abraham, T. J., Sen, A., Das, R., Sinha, P., Boda, S., & Patil, P. K.** (2025). Haemato-biochemistry, erythromorphology, and histopathology of *Oreochromis niloticus* as influenced by *Aeromonas hydrophila* infection and florfenicol therapy. Animal Research and One Health, 3(1), 54–70.

59. **Sharon, J., Abraham, T. J., Sen, A., Sinha, P., Das, R., Uma, A., & Patil, P. K.** (2025). Florfenicol therapy reduces brain histoarchitectural anomalies in *Streptococcus agalactiae*-infected Nile tilapia *Oreochromis niloticus*. Journal of Ocean University of China, 24(6), 1719–1727.

60. **Murugan, T. S., Praveena, E., Thomas, D., Bera, A., Angel, J. R. J., Thiagarajan, G., Kailasam, M., & Lal, K. K.** (2025). Advancing captive maturation and spawning through induced breeding trials in Goldlined seabream *Rhabdosargus sarba* (Forsskål, 1775). Aquaculture International, 33(3), 203.

61. **Shekhar, M. S., Katneni, V. K., Jangam, A. K., Krishnan, K., Prabhudas, S. K., Raymond, J. J. A., & Lal, K. K.** (2025). Chromosome-level genome assembly with telomeric repeats at scaffold ends for *Rhabdosargus sarba*. Scientific Data, 12(1), 1202.

62. **Sinha, P., Abraham, T. J., Sen, A., Sharon, J., Das, R., Rajeshwar, B. N., Uma, A., & Patil, P. K.** (2025). Influence of in-feed oxolinic acid therapy on the brain histoarchitecture and virulence factors of *Streptococcus agalactiae* infecting Nile tilapia *Oreochromis niloticus*. Highlights in BioScience, 8.

63. **Solanki, H. G., Verma, A., Solanki, H. K., Raja, R. A., Avunje, S., Trangadia, B. J., Panda, S. K., & Patil, P. K.** (2025). Biosafety and withdrawal period of in-feed administered antiparasitic drug emamectin benzoate in *Cirrhinus mrigala* (Hamilton, 1822). Journal of Veterinary Pharmacology and Therapeutics, 48(2), 123–132.

64. **Sundaram, M., Panigrahi, A., Saranya, C., Das, R. R., Biju, I. F., Sudheer, N. S., Anand, P. S., Dayal, S., Vasagam, K., & Jayanthi, M.** (2025). Emphasizing the comparison between biofloc and semi-floc systems with respect to productivity and immune responses of *Penaeus vannamei* (Boone, 1931). Aquaculture International, 33(6), 612.

65. **Suvana, S., Muralidhar, M., Lalitha, N., Avunje, S., Baldev, E., Kumararaja, P., Saraswathy, R., Vinay, T.N., Gopinath, D., Rajesh, R., & Nagavel, A.** (2025). Comparative disinfection and residual effect of peracetic acid with other disinfectants in aquaculture. Acta Scientific Agriculture. 9(3), 69-75.

66. **Swain, S., Praveena, P. E., Bhuvaneswari, T., Panigrahi, A., Lal, K. K., & Otta, S. K.** (2025). A simple way of using prebiotic

towards sustainable shrimp aquaculture practice. Aquaculture International, 33(4), 297.

67. **Tandel, R. S., Dash, P., Bhat, R. A. H., Kalingapuram, K., & Sharma, P.** (2025). Skeletal deformities in farmed Rainbow trout, *Oncorhynchus mykiss*, at an early stage of development: A case study of Indian Himalayan States. Journal of Applied Ichthyology, 2025(1), 1923763.

68. **Vidya, R., Raja, R. A., Avunje, S., Bhuvaneswari, T., Kumar, T. S., Aravind, R., Raymond, J. A. J., Vasagam, K. P. K., Poornima, M., & Jithendran, K. P.** (2025). A report on outbreak of *Amyloodinium ocellatum* infestation in broodstock of Java rabbitfish, *Siganus javus* (Linnaeus, 1766). Journal of Parasitic Diseases, 49(1), 45–56.

Books /Book Chapter

1. **Anantharaja, K., Krishnan, P., Verma, A. K., Prasanth, H., Swain, S. K., Kantharajan, G., Abuthagir Iburahim, S., Bharathi, S., & Routray, P.** (2026). Trends and developments in aquaponics research: A scientometric analysis. In S. A. Dar, I. Qayoom, G. B. Wani, A. Abubakr, & S. Zehra (Eds.), Recent advances in sustainable aquaculture and fisheries (pp. 213–248). Apple Academic Press.

2. **Falguni, M., Rathod, I., Ajithkumar, P., Poornima, M., & Verma, S.** (2025). Exploring dimensions of life science research (1st ed.). Bhumi Publishing.

3. **Jeena, K., Makesh, M., Bedekar, M. K., Shyam, K. U., Dhar, A. K., & Rajendran, K. V.** (2025). Disease diagnosis in aquaculture. In R. Kooloth Valappil, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (Chapter 18). (pp. 569–626). Springer.

4. **Kanagachidambaresan, G. R., Rohini, P., Jayasudha, V., Thipperudraswamy, S. P., Pandiaraj, M., Mathiyarasu, J., Kumararaja, P., & Muralidhar, M.** (2025). Machine learning based voltage prediction with various levels of pH in IoT environment. In A. Verma, P. Verma, K. K. Pattanaik, R. Buyya, & D. Dasgupta (Eds.), Advanced network technologies and intelligent computing (pp. 201–215). Springer.

5. **Krishnani, K. K., Abisha, R., & Muralidhar, M.** (2025). Bioremediators in shrimp aquaculture. In K. V. Rajendran, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (pp. 705–731). Springer Nature Singapore.

6. **Kumar, S., & Alavandi, S. V.** (2025). Bacterial diseases in brackishwater aquaculture. In K. V. Rajendran, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (pp. 31–58). Springer Nature Singapore.

7. **Kumar, S., & Shekhar, M. S.** (2025). Status and management of bacterial diseases in shrimp farming. In: Singh, P., Singh, A., Tyagi, A., Benjakul, S. (eds) Shrimp Culture Technology (pp. 269–282). Springer, Singapore.

8. **Lal, K. K., Behera, B. K., Ambasankar, K., Shekhar, M. S., Neeraj, S., Pradhan, P. K., Makesh, M., Otta, S. K., Katneni, V. K., Ananda Raja, R., Ashok Kumar, J., Kumar, S., Raymond, J. A. J., Sathishkumar, T., & Lini, M.** (2025). Compendium of abstracts, 12th symposium on diseases in Asian aquaculture: Transformative innovations shaping the future of aquatic animal health management. ICAR-Central Institute of Brackishwater Aquaculture.

9. **Makesh, M., Rajendran, K. V., & Girisha, S. K.** (2025). Viral diseases in brackishwater fishes. In K. V. Rajendran, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (pp. 139–174). Springer.

10. **Muralidhar, M., & Avunje, S.** (2025). Impact of climate change on animal health in aquaculture systems. In K. V. Rajendran, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (pp. 507–527). Springer Nature Singapore.

11. **Nila Rekha, P., Nishan Raja, R., Sunny, A., Sarkar, S., Aravind Kumar, S., & Balasubramanian, C. P.** (2025). Geospatial evaluation of SLR and LULC influence on groundwater quality in coastal watershed of Thiruvallur District, Tamil Nadu, India. In: Sunitha, V., Muralidhara Reddy, B., Sudharshan Reddy, Y., Prasad, M., Pradeep Kumar, B., Balaji, E. (eds) Groundwater resource management planning strategies: A geospatial approach (Vol. 1, pp. 825–836). Springer Water. Springer, Cham.

12. **Otta, S. K., & Karunasagar, I.** (2025). Application of probiotics, immunostimulants and bacteriophages in aquaculture. In K. V. Rajendran, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (pp. 685–703). Springer Nature Singapore.

13. **Panigrahi, A., Raymond, J. A. J., Aravind, R., Siva, C., Anand, P.S.S., Saravanan, K., Vasagam, K. P., Saraswathy, R., Otta, S. K., & Jayanthi, M. (Eds.).** (2025). Advanced aquaculture practices for resilient and sustainable development in Odisha. ICAR-Central Institute of Brackishwater Aquaculture.

14. **Poornima, M., Nalayeni, K., Sathish Kumar, T., & Vidya, R.** (2025). Disease syndromes in farmed shrimp. In R. Kooloth Valappil, I. Karunasagar, & I. Karunasagar (Eds.), Aquatic animal health management (Chapter 12). Springer Nature.

15. **Poornima, M., Renjith, R. K., Kahate, P. M., & Verma, S.** (2025). Sustainable approaches in aquatic science (1st ed.). Bhumi Publishing.

16. **Raja, R. N., Rekha, P. N., Sunny, A., Sarkar, S., & Kumar, S. A.** (2025). Assessment of flood impact on groundwater quality in the coastal areas of Thiruvallur District, Tamil Nadu, India, In: Sunitha, V., Muralidhara Reddy, B., Sudharshan Reddy, Y., Prasad, M., Pradeep Kumar, B., Balaji, E. (eds) Groundwater Resource Management Planning Strategies. Springer Water. Springer, Cham.

17. **Rakholiya, Y., Singh, R., Poornima, M., & Mahajan, M.** (2025). Science and technology for sustainable future (1st ed.). Bhumi Publishing.

18. **Saraswathy, R., Muralidhar, M., Antony, J., & Kumararaja, P.** (2025). Water quality management in shrimp aquaculture. In: M. Kumaran, K. P. Vasagam, & K. K. Lal (Eds.), The advances in brackishwater aquaculture: A handbook for aqua farmers (pp. 27–34). ICAR-Central Institute of Brackishwater Aquaculture.

19. **Sarwat, M. S., Sura, S., Poornima, M., & Gracelin, D. H. S.** (2025). Integrative approaches in modern life science (1st ed.). Bhumi Publishing.

20. **Vithalrao, N., Mulchandani, S., Anamika, & Poornima, M.** (2025). Applied biotechnology: Techniques and applications (1st ed.). Bhumi Publishing.

Popular Articles

1. **Ajay, R., Kumaran, M., Raja, R.A., & Suresh, A.** (2025). Argulus disease in finfish aquaculture. Namadhu Ariviyal (Tamil Science Magazine), 7(82), 22–25.

2. **Poornima, M., Nalayeni, K., Rajan, J. J. S., & Shekhar, M.S.** (2025). Postbiotics: Application, pros and cons in shrimp culture. Aqua Tech Magazine, October 2025, 76–78.

3. **Poornima, M., Nalayeni, K., Venkateswarlu, P., Purkait, S., Goud, S. V., & Akhil Kumar, K.** (2025). Multi strain probiotics (MSP): Application in shrimp aquafarming. AquaTech magazine, January 2025, 84–85.

4. **Shekhar, M. S., Kumar, S., Kumar, T. S., & Lal, K. K.** (2025). Mitigating the impact of diseases on the aquaculture industry's economic viability and sustainability: Role of ICAR-Central Institute of Brackishwater Aquaculture. Transformative innovations shaping the future of aquatic animal health management: Souvenir book 12th symposium on diseases in Asian aquaculture (DAA 12). 25–28.

Conference / Symposia/ Workshop Presentations

1. **Ananda Raja, R., Patil, P.K., Dixit, A., Vidya, R., Kumararaja, P., Sandeep, K.P., Sivaramakrishnan, T., Shekhar, M.S., & De, D.** (2025). Pharmacodynamics and pharmacokinetics of lufenuron, an anti-parasitic drug in Asian seabass, *Lates calcarifer* fingerlings under tropical Indian climate. Presented in 14th Asian Fisheries and Aquaculture Forum (14AFAF). Theme: Greening the blue growth in Asia-Pacific organised by Asian Fisheries Society (AFS), Kuala Lumpur, Malaysia; Indian Council of Agricultural Research (ICAR), New Delhi, India, Department of Fisheries (DoF), Government of India, New Delhi and India and Asian Fisheries Society Indian Branch (AFSIB), Mangalore, Indi at ICAR Convention Centre, NASC

Complex, New Delhi, India. 12-15 February 2025. pp. 447.

2. **Ananda Raja, R., Panigrahi, A., Otta, S.K., Sujeet Kumar., Vidya, R., Sathish Kumar, T., Dixit, A., Joseph, S.R., & Shekhar, M.S.** (2025). Host range susceptibility to *Ecytonucleospora hepatopenaei* (EHP) infection in brackishwater aquaculture. In: Kuldeep K. Lal, Behera, B.K., Ambasankar, K., Shashi Shekhar, M., Neeraj Sood, Pradhan, P.K., Makesh, M., Otta, S.K., Vinaya Kumar, K., Ananda Raja, R., Ashok Kumar, J., Sujeet, K., Raymond, J.A.J., Sathishkumar, T., Mary Lini., 2025. Compendium of Abstracts, 12th Symposium on Diseases in Asian Aquaculture: Transformative Innovations Shaping the Future of Aquatic Animal Health Management. ICAR-Central Institute of Brackishwater Aquaculture, Chennai, India. 23-27 September 2025. pp. 265.

3. **Ananda Raja, R., Dixit, A., Sujeet Kumar., Vidya, R., Sathish Kumar, T., Joseph Sahaya Rajan, J., Panigrahi, A., & Shashi Shekhar, M.** (2025). Eco-friendly prophylactics and therapeutics with nanoparticle delivery mechanism as an alternative to antimicrobials for management of shrimp diseases of economic importance. Presented in IAVPCON 2025 XLII Annual Conference of Indian Association of Veterinary Pathologists & XVI Annual Meeting of Indian College of Veterinary Pathologists and National Symposium on Bridging conventional and artificial intelligence based digital pathology for maximum outreach – A futuristic approach to veterinary disease diagnosis organised by the Department of Veterinary Pathology, Ranchi College of Veterinary Science & Animal Husbandry, Indian Association of Veterinary Pathologists and Indian College of Veterinary Pathologists. 4-6 December 2025. pp. 285.

4. **Ananda Raja, R., Lal, K.K., Muralidhar, M., Patil, P.K., & Kanagachidambaresan, R.** (2025). Design and implementation of IoT with block chain-based traceability system for shrimp supply chain management. In: Kuldeep K. Lal, Behera, B.K., Ambasankar, K., Shashi Shekhar, M., Neeraj Sood, Pradhan, P.K., Makesh, M., Otta, S.K., Vinaya Kumar, K., Ananda Raja, R., Ashok Kumar, J., Sujeet, K., Raymond, J.A.J., Sathishkumar, T., Mary Lini., 2025. Compendium of Abstracts, 12th Symposium on Diseases in Asian Aquaculture: Transformative Innovations Shaping the Future of Aquatic Animal Health Management. ICAR-Central Institute of Brackishwater Aquaculture, Chennai, India. 23-27 September 2025. pp. 262.

5. **Ananda Raja, R., Kumaran, M., Sairam, C.V., Shanthi, B., Deboral Vimala, D., & Jagan, M.R.N.** (2025). Establishment of field disease diagnostic laboratory for servicing and capacity building of marginalized society in brackishwater aquaculture. In: Kuldeep K. Lal, Behera, B.K., Ambasankar, K., Shashi Shekhar, M., Neeraj Sood, Pradhan, P.K., Makesh, M., Otta, S.K., Vinaya Kumar, K., Ananda Raja, R., Ashok Kumar, J., Sujeet, K., Raymond, J.A.J., Sathishkumar, T., Mary Lini., 2025. Compendium of Abstracts, 12th Symposium on Diseases in Asian Aquaculture: Transformative Innovations Shaping the Future of Aquatic Animal Health Management. ICAR-Central Institute of Brackishwater Aquaculture, Chennai, India. 23-27 September 2025. pp. 264.

6. **Abhaya, R., Kumar, S., Nishanthini, B., Akshay, P., Sadanandan, Rajan, J.S., Vidya, R., & Shekhar, M.S.** (2025). Targeted biocontrol of *Vibrio parahaemolyticus* using bacteriophage in aquaculture. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept. 2025. pp 149.

7. **Abhaya, R., Nishanthini, B., Vidya, R., Shekhar, M.S., & Kumar, S.** (2025). Characterization of broad-spectrum bacteriophages against vibrio infections in aquaculture. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February. 2025. New Delhi, India.

8. **Akshay, P. S., Jayanthi, M., Samynathan, M., Thirumurthy, S., & Muralidhar, M.** (2025). Assessment of unused land soil characteristics for brackishwater aquaculture planning: A case study in Raigad District of Maharashtra. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India.

9. **Anand, P.S.S., Sangeetha, L., Bavithra, K., Siva, C., Priyadarshini, K., Aravind, R., Dinesh, P., Surya, R., & Panigrahi, A.** (2025). Comparative performance of *Penaeus indicus* in indoor and outdoor culture systems: Insights from heterotrophic, clear water and recirculatory aquaculture setups. Marine Ecosystems: Challenges and Opportunities (MECOS), Cochin, 4-6 November 2025. Pp170.

10. **Anand, P.S.S., Sangeetha, V.K.L.M., Bavithra, K., Priyadarshini, K., Siva, C., Aravind, R., Kumar, S., Balasubramanian, C.P., Panigrahi, A., & Lal, K. K.** (2025). Physiological responses and microbial profile of Indian white shrimp *Penaeus indicus* brooders reared under different culture systems. 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept. 2025. Chennai. Pp113

11. Anantharaja, K. (2026). Recent advances in brackishwater aquaculture in India. In National Conference on Marine Resources Conservation and Valorization for Blue Revolution (MRCVBR-2026). 09 Jan 2026. Vivekanandha College, Sankagiri, Salem.

12. Antony, J., Saraswathy, R., Muralidhar, M., Raymond, J. A. J., Anand, P.S.S., & Panigrahi, A. (2025). Site suitability assessment of inland saline groundwater resources based on farm productivity and ionic parameters. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India.

13. **Antony, J., Saraswathy, R., Muralidhar, M., Raymond, J.A.J., Anand, P.S.S., & Panigrahi, A.** (2025). Site suitability assessment of inland saline groundwater resources based on farm productivity and ionic parameters. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025, New Delhi, India.

14. **Antony, J., Thomas, D., Panigrahi, A., Mahalakshmi, P., & Lal, K.K.** (2025). Size grading improves growth rate and population structure of pearlspot *Etroplus suratensis*. International symposium, MECOS4, Marine Ecosystems Challenges and Opportunities, 4-6 November 2025, ICAR CMFRI, Kochi.

15. **Aravind, R., Rekha, P. N., Angel, R. J., Kumar, S. A., Anand, P. S. S., Dayal, J. S., Ambasankar, K., Panigrahi, A., Balasubramanian, C. P., & Lal, K. K.** (2025). Emerging integrated technology for brackishwater seaweed–shrimp farming: A sustainable model for coastal aquaculture. In World Aquaculture India 2025, 10–13 November 2025, Hyderabad, India.

16. **Aravind, R., Rekha, P.N., Angel, R.J., Kumar, S.A., Anand, P.S.S., Dayal, J.S., Ambasankar, K., Panigrahi, A., Balasubramanian, C.P., & Lal, K.K.** (2025). Emerging integrated technology for brackishwater seaweed-shrimp farming: A sustainable model for coastal aquaculture. In Proceedings of World Aquaculture India 2025, November 10-13, Hyderabad, India.

17. **Ashok Kumar, J., Vinaya Kumar, K., Nimisha, K., Suganya, P. N., Gangaraj, K. P., Sudheesh, K. P., Chaturvedi, K. K., Syama Dayal, J., & Shekhar, M. S.** (2025). Insights on unique genes and pathways of cultured shrimp species identified through pangenome analysis. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025, New Delhi, India.

18. **Bavithra, K., Anand, P.S.S., Sangeetha, L., Siva, C., Priyadarshini, K., Aravind, R., Katneni, V. K., Tomy, S., & Panigrahi, A.** (2025). Induced maturation in Indian white shrimp *Penaeus indicus* through hormonal administration. In Marine Ecosystems Challenges and Opportunities (MECOS) 4, Chennai, 4-6 November 2025, Pp 174.

19. **Bavithra, K., Anand, P.S.S., Sangeetha, V.K.L.M., Siva, C., Raymond, J.A.J., Raja, R.A., Sujeet Kumar, & Balasubramanian, C.P.** (2025). Influence of nursery culture conditions on microbial dynamics and physiological responses in juvenile *Penaeus japonicus* Form II. In 12th Symposium on Diseases in Asian Aquaculture, Chennai, 23-27 Sept. 2025. Pp 102.

20. **Bera, A., Kailasam, M., Thomas, D., Sivaramakrishnan, T., Thiagarajan, G., Subburaj, R., Muralidhar, M., & Lal, K. K.K. (**2025). Milkfish (Chanos chanos) a promising climate resilient species for semi-intensive culture in coastal and inland regions. In International Conference on Rainfed Agriculture:

Building Pathways for Resilience & Sustainable Livelihoods, ICAR-CRIDA, 29-31 January 2025, Hyderabad, India.

21. **Bera, A., Muralidhar, M., Kailasam, M., Thomas, D., Thiagarajan, G., Subburaj, R., & Lal, K. K.** (2025). Temperature controlled breeding system for year-round seed production of pearlspot (*Etroplus suratensis*). In National Level Workshop on Sustaining Aquatic Ecosystems in A Changing Climate: Resilience, Mitigation and Adaptation Strategies, TNFU, 20 March 2025, Ponneri, India.

22. **Bera, A., Muralidhar, M., Thomas, D., Romertho, S., Ezhil, P., Thiagarajan, G., Subburaj, R., Kailasam, M., & Lal, K. K.** (2025). Enhanced breeding and seed production of pearlspot (*Etroplus suratensis*) in temperature controlled indoor RAS system. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India.

23. **Bhuvaneshwari, R., Namrita, M., Kaikkolante, N., Jose, I.M., Katneni, V. K., Tomy, S., Makesh, M., Kailasam, M., & Lal, K. K.** (2025). *in silico* identification of differentially expressed miRNAs in Asian seabass (*Lates calcarifer*) infected with nervous necrosis virus. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

24. **Chandrabhushan, N., Rahul, T., Irshad, A.S., Modi, K., Bera, A., & Tomy, S.** (2025). Computational insights into probiotic-pathogen interactions in biofloc-based brackishwater aquaculture. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

25. **Dash, P., & Tandel, R.S.** (2025). Essential oils based nanoemulsions against aquatic pathogenic oomycetes, *Saprolegnia parasitica* and S. *australis*: *in vitro* and *in vivo* study. In 12th Symposium on Diseases in Asian Aquaculture, 23rd to 27th Sep, 2025, Chennai.

26. **Dash, P., Sundi, S., Antony, J., & Patil, P.A.** (2025). Growth and nutrient uptake of *Gracilaria corticata* under different nutrient conditions for sustainable land based production. In 14th Asian Fisheries and Aquaculture Forum, 12 to 15th Feb 2025, New Delhi, India

27. **Dayal, J. S., Vasagam, K.P., Ambasankar, K., Sravanthi, O., Panigrahi, A., & Muralidhar, M.** (2025). Effect of fish meal replacement with raw or fermented groundnut oil cake on growth, nutrient utilization and greenhouse gases emission in Pacific white shrimp, *Penaeus vannamei*. In International Conference on Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods, 29-31 January 2025, Hyderabad, India. pp. 1160.

28. **Dixit, A., Ananda Raja, R., Patil, P.K., & Sandeep, K.P.** (2025). Biological effects of florfenicol on environmental toxicity indicator organisms: Microalga, *Chlorella marina* and Copepod, *Apocyclops* sp. Presented in 14th Asian Fisheries and Aquaculture Forum (14AFAF). Theme: Greening the blue growth in Asia-Pacific organised by Asian Fisheries Society (AFS), Kuala Lumpur, Malaysia; Indian Council of Agricultural Research (ICAR), New Delhi, India, Department of Fisheries (DoF), Government of India, New Delhi and India and Asian Fisheries Society Indian Branch (AFSIB), Mangalore, Indi at ICAR Convention Centre, NASC Complex, New Delhi, India. 12-15 February 2025. pp. 456.

29. **Dixit, A., Ananda Raja, R., Patil, P.K., Aritra, B., Dani, T., & Kumar, A.** (2025). Natural infestation of sea lice (*Caligus* sp.) and gill fluke (*Dactylogyrus* sp.) in silver moony, *Monodactylus argenteus*: A case study. Presented in 14th Asian Fisheries and Aquaculture Forum (14AFAF). Theme: Greening the blue growth in Asia-Pacific organised by Asian Fisheries Society (AFS), Kuala Lumpur, Malaysia; Indian Council of Agricultural Research (ICAR), New Delhi, India, Department of Fisheries (DoF), Government of India, New Delhi and India and Asian Fisheries Society Indian Branch (AFSIB), Mangalore, Indi at ICAR Convention Centre, NASC Complex, New Delhi, India. 12-15 February 2025. pp. 523.

30. **Dixit, A., Ananda Raja, R., Patil, P.K., Sandeep, K.P., Vidya, R., Krupesh, C.K., Bharath, G., & Swarnalatha, B.** (2025). Biological effects of praziquantel (PZQ) on

environmental toxicity indicator organisms: Microalga, *Chlorella marina* and copepod, *Apocyclops* sp. In: Kuldeep K. Lal, Behera, B.K., Ambasankar, K., Shashi Shekhar, M., Neeraj Sood, Pradhan, P.K., Makesh, M., Otta, S.K., Vinaya Kumar, K., Ananda Raja, R., Ashok Kumar, J., Sujeet, K., Raymond, J.A.J., Sathishkumar, T., Mary Lini., 2025. Compendium of Abstracts, 12th Symposium on Diseases in Asian Aquaculture: Transformative Innovations Shaping the Future of Aquatic Animal Health Management. ICAR-Central Institute of Brackishwater Aquaculture, Chennai, India. 23-27 September 2025. pp. 141.

31. **Ezhil, P., Janakiraman, R.B., Otta, S.K., & Bhuvaneswari, T.** (2025). *Ectyonucleospora hepatopenaei* (EHP): A new frontier for veterinary pathology in aquatic health presented as lead paper in the session Lab, Aquatic and Wild Animal Pathology. In 42nd Annual Conference of Indian Association of Veterinary Pathologists-IAVPCON25, from 4th - 6th December, 2025, Ranchi Veterinary College, Birsa Agricultural University, Kanke, Ranchi, Jharkhand, India

32. **Geetha, R., Jayakumar, R., Vimala, D., Bhuvaneshwari, T., Karthik, V., & Kailasam, M.** (2026). Women-Managed Cage Farming of Asian seabass as a resilient livelihood option in coastal agri-food systems. In Global conference on Women in Agri food Systems (GCWAS 2026), 12-14 March 2026. National Agriculture Science Centre (NASC), New Delhi.

33. **Gopinath, D., Muralidhar, M., Jayanthi, M., Dayal, J. S., Sravanthi, O., Dharmadurai, M., & Rajesh, R.** (2025). Impact of cyclone-induced extremely heavy rainfall and flood on pond water quality and shrimp immunological parameters: A case study in Andhra Pradesh. 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India. 663.

34. **Gopinath, D., Muralidhar, M., Nagavel, A., & Kumar, T.S.** (2025). Impact of rainfall pattern variability on changes in water quality, immune parameters and incidence of white spot disease in tiger shrimp. In International Conference on Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods, ICAR-CRIDA, 29-31 January 2025, Hyderabad, India. 1151.

35. **Irine, M. J., Katneni, V. K., Jangam, A. K., Shekhar, M.S., Kaikkolante, N., Udayakumar, G.H., & Sudheesh, K. P.** (2025). Long noncoding RNA mediated cis and trans regulation of mRNA expression in response to white spot syndrome virus infection in *Penaeus vannamei*. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai

36. **Irshad, A.S., Chandrabhushan, N., Rahul, T., Ben, G.A., Tomy, S., & Bera, A.** (2025). Infestation dynamics, site specific distribution and histopathological changes associated with the sea louse *Caligus rotundigenitalis* in Pearlspot *Etroplus suratensis* (Bloch). In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

37. **Jayakumar, R., Geetha, R., Vimala, D., Bhuvaneshwari, T., Karthik, V., & Kailasam, M.** (2026). Integrating women into coastal agri-food systems through nursery rearing of Asian seabass under societal development programs. In Global conference on Women in Agri food Systems (GCWAS 2026), 12-14 March 2026. National Agriculture Science Centre (NASC), New Delhi.

38. **Jayakumar, R., Subburaj, R., Thiagarajan, G., & Kailasam, M.** (2025). Prospects of brackishwater aquaculture in blue economy in the National Seminar on empowering of the Blue Economy through the Ocean's Wealth, 30th October, 2025, Bharathidasan University, Tiruchirappalli.

39. **Jayakumar, R., Tomy, S., Thomas, D., Bera, A., Sandeep, K.P., Subburaj, R., Thiagarajan, G., & Kailasam, M.** (2025). Comparative analysis of gonadal maturity and haematological parameters in hormone pellet implanted streaked spine foot rabbit fish *Siganus javus*. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025, New Delhi, India. Pp 190.

40. **Jayanthi, M., Muralidhar, M., Saraswathy, R., Panigrahi, A., & Lal, K.K.** (2025). Aquaculture spatial

planning in India: Present status and the way forward. In World Aquaculture Society, 10-13 November 2025, Hyderabad.

41. **Jayanthi, M., Panigrahi, A., & Lal, K.K.** (2025). Aquaculture spatial planning for blue transformation in coastal regions and beyond in Odisha, India. In 2nd Indian Fisheries Outlook-2025, 12-14 July 2025, Odisha, India.

42. **Jayanthi, M., Thirumurthy, S., Samynathan, M., Akshay, P.S., Otta, S.K., Patil, P.K., & Panigrahi, A.** (2025). Mapping of shrimp farms and shared environmental risks in disease spread: A case study in Chengalpattu District, Tamil Nadu. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai.

43. **Jayanthi, M., Thirumurthy, S., Samynathan, M., Akshay, P.S., Patil, P.A., Muralidhar, M., Saraswathy, R., Panigrahi, A., & Lal, K.K.** (2025). Aquaculture Spatial Planning: A tool for the expansion of responsible aquaculture. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025. New Delhi, India

44. **Joshua, X.N.S., Kalaibharathi, R., Shaik, I.A., Pranali, M., Balagopal, K.B., Thiagarajan, G., Bhuvaneshwari, T., Bera, A., Kailasam, M., & Tomy, S.** (2025). Impact of acute salinity fluctuations on host immunity and pathogen susceptibility in *Etroplus suratensis*. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

45. **Kaikkolante, N., Katneni, V. K., Jangam, A. K., Shekhar, M.S., Irine, M.J., Udayakumar, G.H., & Sudheesh, K.P.** (2025). Computational discovery of shrimp RNAi-mediated silencing targets in white spot syndrome virus genome. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai.

46. **Kalaibharathi, R., Bhuvaneshwari, R., Joshua Xavier, N., Namritha, M., Shaik Irshad Ali, Chandrabhushan, N., Rahul Thakur, Thiagarajan, G., Bhuvaneshwari, T., Bera, A., Kailasam, M., & Tomy, S.** (2025). The immune response of Asian seabass (*Lates calcarifer*) and its susceptibility to bacterial infection at different salinity levels. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

47. **Kanagachidambaresan, G. R., Rohini, P., Muralidhar, M., Pulikandla, A. R., Dharmadurai, M., & Jangam, A. K.** (2025). Water quality monitoring and advisory systems using real-time sensors and gpts for precision brackishwater aquaculture. In IEEE International Conference on Computer, Electronics, Electrical Engineering & Their Applications (IC2E3), 15-16 May 2025, Srinagar Garhwal, India. 1–7.

48. **Katneni, V. K., Shekhar, M.S., Ashok Kumar, J., Sudheesh, K.P., Karthic Krishnan, Kumaravel, J., Kaikkolante, N., Irine Maria Jose, Raymond, J.A.J., & Kailasam, M.** (2025). Chromosome-scale genome assembly for *Siganus javus*. In 14th Asian Fisheries and Aquaculture Forum, 12–15 February 2025, New Delhi, India.

49. **Katneni, V. K., Shekhar, M.S., Jangam, A. K., Vasagam, K.P., & Raymond, J.A.J.** (2025). Telomere to telomere genome assembly for brackishwater fishes, Pearlspot and Goldlined seabream. PAG Asia 2025 (India), 18–20 March, 2025, Gurgaon, New Delhi, India.

50. **Kumar, S., Nishanthini, B., Abhaya, R., Kumar, T.S., A Raja, R.A., Makesh, M., & Shekhar, M.S.** (2025). Comparative genomics of Harveyi clade: insight into virulence related factors. In 14th Asian Fisheries and Aquaculture Forum, February 12-15, 2025 in New Delhi, India. pp 462.

51. **Kumar, S., Nishanthini, B., Abhaya, R., Kumar, T.S., Raja, R.A., Makesh, M., & Shekhar, M.S.** (2025). Characterization of *Vibrio parahaemolyticus* isolated from *Penaeus vannamei* affected with white feces syndrome, In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. pp 89.

52. **Kumaravel, J., Sudheesh, K.P., Ashok, S., Katneni, V. K., Jangam, A. K., & Shekhar, M.S.** (2025). Transcriptomic analysis of WSSV infected Indian white shrimp (*Penaeus indicus*) exposed to elevated temperature. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai, 106.

53. **Lalitha, N., Rajesh Raj, R., Nagavel, A., & Muralidhar, M.** (2025).

Enriched methanotrophic communities isolation and activity screening from brackishwater systems. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025, New Delhi, India. Pp. 652.

54. **Mahalakshmi, P., Debasis De, & Sandeep, K.P.** (2025). Fish Waste Valorization: A new-age technology for empowering coastal entrepreneurs and doubling farmers' income. Lokesh Gupta, Chhatarpal Singh, and Sanjay Kumar Jha (eds.). In: 12th International Conference on Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development (EIAFTBASGD-2025), November 15-17, 2025 Rajasthan, India. Pp. 58.

55. **Mahalakshmi, P., Ravisankar, T., Sairam, C.V., & Prabhu, S.** (2025). Energy use pattern in shrimp production: optimizing energy utilization for sustainable shrimp farming. Lokesh Gupta, Chhatarpal Singh and Sanjay Kumar Jha (eds.). In 12th International Conference on Emerging Issues in Agricultural, Food Technology, Biological & Applied Sciences for Global Development (EIAFTBASGD-2025), November 15-17, 2025. Rajasthan, India. Pp. 56-57.

56. **Makesh, M., Kumar, K. A., Bhuvaneswari, T., Bera, A., Kailasam, M., & Lal, K. K.** (2025). Development of Asian seabass (*Lates calcarifer*) muscle cell line for production of cultured fish meat. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025. New Delhi

57. **Makesh, M., kumar, K. A., Otta, S.K., Kumar, S. & Kailasam, M.** (2025). Markerless expression of Nervous necrosis virus capsid protein in microalgae. In 12th International Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai.

58. **Muralidhar, M., Dayal, J. S., Viswajeet Potadar, Ashok Kumar, J., Kumararaja, P., Jayanthi, M., Saraswathy, R., Kumaran, M., & Panigrahi, A.** (2025). Life cycle assessment approach to evaluate environmental impacts in shrimp aquaculture. In: 'Resilience Through Livestock and Fisheries in Rainfed Regions. In International Conference on Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods, 29-31 January 2025. ICAR-CRIDA, Hyderabad. Pp 1149

59. **Muralidhar, M., Dharmadurai, M., Nagavel, A. S., Gopinath, D., Rajeshraj, S., Kumararaja, P., & Saraswathy, R.** (2025). Field colorimetric determination of critical parameters in aquaculture pond waters of varying salinity. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India. Pp. 297.

60. **Muralidhar, M., Kumararaja, P., Saraswathy, R., Suvana, S., Nagavel, A., Jayanthi, M., & Dayal, J. S.** (2025). Influence of cropping pattern and culture practices on greenhouse gases emission in shrimp farms. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India. pp. 666.

61. **Muralidhar, M., Saraswathy, R., Panigrahi, A., & Lal, K. K.** (2025). Aquaculture spatial planning: A tool for the expansion of responsible aquaculture. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India. pp. 182.

62. **Nishanthini, B., Kumar, S., Abhaya, R., Kumar, T.S., Anand, P.S.S., Makesh, M., & Shekhar, M.S.** (2025). Pathogenicity of *Vibrio harveyi* in Asian seabass *Lates calcarifer*. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept 2025. Pp 33

63. **Patil, P.A.** (2025). Cage aquaculture in open coastal waters for sustainable blue economy" in the International Fisheries Expo (IFT). In Virtual Info Systems Pvt Ltd (VIS Group). 12-13 July 2025. Goregaon, Mumbai.

64. **Patil, P.A.** (2025). Envisioning an organised, diversified, science driven & socially resilient future aquaculture sector. In discussion on the effect of reciprocal us tariff & way forward to strengthening the domestic market for shrimp. 22nd September 2025. Mumbai

65. **Patil, P.A., Hussain, T., Bera, A., Kailasam, M., & Mahalakshmi, P.** (2025). Nursery rearing of

milkfish, *Chanos chanos* as a livelihood activity by the self-help group of Navsari district, Gujarat. In 14th Asian Fisheries Aquaculture Forum, 10- 16 February 2025 at ICAR Convention Center, New Delhi.

66. **Patil, P.A., Vasagam K.P.K., Kailasam, M., Kandaswamy, M., Mahalakshmi, P., Panigrahi, A., Antony, J., Sundi, S., Khara, S., Dash. P., & Tandel R.S.** (2025). Density optimization of Seabass fry and fingerlings for live transportation. In 14th Asian Fisheries Aquaculture Forum, 10-16 February 2025 at ICAR Convention Center, New Delhi.

67. **Patil, P.A., Vasagam K.P.K., Kailasam, M., Panigrahi, A., Khara, S., Sundi, S., & Mahalakshmi, P.** (2025). Density optimization of pearlspot fry and fingerlings for live transportation. In 2nd Indian Fisheries Outlook, 12-14 July 2025, Berhampir, Odisha.

68. **Kumararaja P, Muralidhar M., Saraswathy R., Satheesha A., Nagavel A., Joseph Sahaya R., Gopinath D., Anjana Krishna Ramesa Babu S., & Shabor D.** (2025) Effect of calcium hypochlorite on inactivation of white spot syndrome virus in shrimp culture ponds of varying soil texture. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai, India.

69. **Poornima, M., Nalayeni, K., Rajan, J.S., Shekhar, M.S., & Lal, K. K.** (2025). One-pot RPA-CRISPR/Cas12a assay for visual detection of White spot syndrome virus (WSSV) in shrimp. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September, 2025, Chennai.

70. **Priyadarshini, K., Anand, P.S.S., Sangeetha, L., Siva, C., Raymond, J.A.J., Bera, A., Bavithra, K., Marbae, P., Sandeep, K.P., Tomy, S., & Lal, K. K.** (2025). Adult Artermia biomass as a bio capsule for targeted nutrient delivery in shrimp broodstock: Role of short and long term enrichment exposure. In Marine Ecosystems Challenges and Opportunities, 4-6 November, 2025, Chennai, Pp 276.

71. **Raymond, J.A.J., Aravind, R., Balasubramanian, C.P., Sandeep, K.P., Antony, J., Sivaramakrishnan, T., Biju, I.F., Anand, P.S.S., Ambasankar, K., & Lal, K. K.** (2025). Optimizing the nursery rearing of *Scylla olivacea* through culture system modification and feeding strategies. In 14th Asian Fisheries and Aquaculture Forum, 12-15 Feb, 2025, New Delhi.

72. **Samynathan, M., Jayanthi, M., & Thirumurthy, S.** (2025). Assessment of aquaculture impact on land use changes through spatial technologies: A model case study of Ramanathapuram District, Tamil Nadu, India. 2nd Indian Fisheries Outlook-2025, 12-14 July 2025, College of Fisheries, OUAT, Berhampur, Odisha, India.

73. **Samynathan, M., Jayanthi, M., Thirumurthy, S., & Akshay, P.S.** (2025). Mapping of salt-affected lands using google earth engine and machine learning techniques in Ramanathapuram District, Tamil Nadu, India. 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025. New Delhi, India

74. **Saraswathy, R., Muralidhar, M., Avunje, S., Rajesh, R., Kumar, T.S., Kumararaja, P., Ravisankar, T., Balasubramanian, C. P., & Lal, K. K** (2025). Amelioration measures to reduce total alkalinity in inland saline aquaculture ponds. In 14th Asian Fisheries and Aquaculture Forum: Greening the Blue Growth in Asia-Pacific, 12-15 February 2025, New Delhi, India. Pp. 186.

75. **Saravanan, K., Praveenraj, J., Kiruba-Sankar, R., Biswas, U., & Devi, V.** (2025). Surveillance of aquatic animal diseases in the tropical archipelago of India: Insights from Andaman and Nicobar Islands. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai, India, Pp. 266.

76. **Saravanan, K., Praveenraj, J., Kiruba-Sankar, R., Devi, V., Sivaramakrishnan, T., Sirisha, A., & Haridas, H.** (2025). Unveiling the bioactive and antibacterial properties of selected seaweed species of Andaman Islands and evaluation of its immunomodulatory potential in fish health management. Compendium of Abstracts, 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai, India, Pp. 30.

77. **Sathish Kumar T., Ambasankar K., Shashi Shekhar M., & Kuldeep Kumar L.** (2025). Phytobiotic intervention for the effective control of *Ecytonucleospora hepatopenaei* (EHP) in shrimp aquaculture. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept. 2025. Chennai

78. **Sathish Kumar, T., Suvetha, S., Makesh, M., & Shekhar, M.S.** (2025). Rapid on-site detection of WSSV and EHP using multiplex LAMP coupled with lateral flow strip. In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai, India

79. **Shanthi, B.** (2025). Coastal women and Irula tribal in brackishwater aquaculture. In National conference on sustainable development goals. 3-4 March 2025 Loyola College, Chennai. pp 22-23.

80. **Shekhar, M.S., Kumaravel, J., Kartic, K., Sudheesh, K.P., Ashok, S., Katneni, V. K., & Jangam, A. K.** (2025). Whole genome sequencing of white spot syndrome virus using nanopore sequencing technology. In Genomics India Conference (GIC), 12–14 August, 2025, Indian Institute of Science, Bengaluru.

81. **Shekhar, M.S., Kumaravel, J., Muralidhar, M., Patil, P.K., Katneni, V. K., Jangam, A. K., Raymond, J.A.J., Sudheesh, K.P., Karthic, K., Panigrahi, A., & Lal, K. K.** (2025). Impact of hyperthermia on white spot syndrome virus replication and host response in Indian white shrimp (*Penaeus indicus*). In 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025. Chennai, Pp 65.

82. **Sivamani, B., Bera, A., Thiagarajan, G., & Kailasam, M.** (2025). Preliminary studies on selective breeding in pearlspot (*Etroplus suratensis*). In 14th Asian Fisheries and Aquaculture Forum, 12–15 February 2025, New Delhi, India.

83. **Sravanthi, O., Dayal, J.S., Ambasankar, K., Gopinath, D., & Muralidhar, M.** (2025). Effect of supplementation of phospholipid for amelioration of temperature stress in Pacific white shrimp. International Conference on Rainfed Agriculture: Building Pathways for Resilience & Sustainable Livelihoods, 29-31 January 2025, Hyderabad, India. pp. 1154.

84. **Subburaj, R., Kailasam, M., Makesh, M., Jayakumar, R., Bera, A., Thiagarajan, G., Thomas, D., & Lal, K. K.** (2025). Comprehensive protocols to control the parasitic infection in Asian seabass broodstock fishes. Conference presentation in 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept. 2025. pp 45.

85. **Tandel, R.S., & Thakuria, D.** (2025). in silico predicted molecular modeling, anti-saprolegnia efficacy, and immunostimulatory potential of a synthetic peptide in fish leucocytes cells. In International Conference on Fisheries Biotechnology, ICFB2025, 17-18 March, 2025

86. **Tandel, R.S., Bhat, R.A.H., & Dash, P.** (2025). Antioxidant, immunostimulatory and antifungal potential of essential oils against Saprolegniasis. In 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025, AFS, ICAR, DOF, GOI and AFSIB, New Delhi, India.

87. **Tandel, R.S., Kalaria, K., Patel Jay, Dash, P., Patil, P., Antony, J., & Nadella, R.** (2025). Biosafety, Pharmacokinetics and Tissue Distribution of Oxolinic acid in Milk fish (*Chanos chanos*). In 12th Symposium on Diseases in Asian Aquaculture, 23-27 Sept. 2025.

88. **Thirumurthy, S., Jayanthi, M., & Samynathan, M.** (2025). Vulnerability assessment in ecologically important coastal regions: A model case study in Chengalpattu District, Tamil Nadu. In 2nd Indian Fisheries Outlook-2025, 12-14 July 2025, Odisha, India.

89. **Thirumurthy, S., Jayanthi, M., Samynathan, M., & Akshay, P.S.** (2025). Shoreline change assessment and the impact of the management measures in dynamic coast through Digital Shoreline Analysis System (DSAS): A case study in muttukadu region of Chengalpattu District, Tamil Nadu. In the 14th Asian Fisheries and Aquaculture Forum, 12-15 February 2025. New Delhi, India

90. **Tomy, S., Navaneeth Krishnan A., Irine Maria J., Gangaraj Karyath P., Sathish Kumar T., Vinaya Kumar K., Subhendu Kumar O., & Jithendran Karingalakkandy P.** (2025).

Transcriptome analysis of the hepatopancreas in the Pacific white shrimp *Penaeus vannamei* in response to *Ecytonucleospora hepatopenaei* (EHP) infection. 12th Symposium on Diseases in Asian Aquaculture, 23-27 September 2025, Chennai.

91. **Tomy, S., Nithoon, J., Saikrithi, P., Balasubramanian, C.P., & Otta, S.K.** (2025). Molecular regulatory mechanisms of gonad inhibiting hormone on ovarian maturation in *Penaeus indicus*. In International Symposium on Marine Ecosystems Challenges and Opportunities (MECOS 4), 4–6 November, 2025, Kochi.

92. **Vidya, R., Bharath, G., Krupesh, C. K., Raja, R.A, & Patil, P. K.** (2025). Praziquantel treatment: A strategy for combatting gill flukes in Asian seabass (*Lates calcarifer*). In 14th Asian Fisheries and Aquaculture Forum, 12–14 February 2025, New Delhi, India.

93. **Vidya, R., Raja, R.A., & Patil, P. K.** (2025). Approaches to managing parasitic infections in fish culture. In 12th Symposium on Diseases in Asian Aquaculture: Transformative Innovations Shaping the Future of Aquatic Animal Health Management, 23-27 September 2025, Chennai, India.

Training Manuals

1. From Seed to Harvest: Hands-on Training in Mud Crab Aquaculture. CIBA TM Series No: 53/2025/3.
2. Hands-on training program on "NGS data analysis". CIBA/TM Series No.54/2025/4.
3. Hands-on training on "Nutrition, feed technology and health management in brackishwater aquaculture". CIBA/TM Series No.55/2025/5.
4. Advances and innovation in brackishwater finfish hatchery production and farming systems. CIBA/TM Series No.57/2025/7.
5. Mud Crab Farming: A Practical Hatch-to-Harvest Training. CIBA/TM Series No.58/2025/8
6. Entrepreneurship development in aquatic animal health management. CIBA Training Manual Series No. 51.

Extension Series

1. *Ecytonucleospora hepatopenaei* (EHP) and white faces syndrome (WFS) in shrimp culture. Effective management strategies with special emphasis to CIBA EHP CURA gro + - A phyto biotic solution. CIBA Extension Series No.104
2. Shrimp Crop Insurance (NFDB funding). CIBA Extension Series No.105
3. Awareness meeting of CIBA EHP Cura held for shrimp farmers at Nagapattinam. CIBA Extension Series No.63
4. CIBA EHP CURA gro + एसाइटोन्यूक्लियोस्पोरा हेपाटोपेनेई (EHP) और व्हाइट फेसेज सिंड्रोम (WFS) के लिए एक फाइटोबायोटिक आधारित उन्नत समाधान. CIBA Extension Series No. 39/2025.
5. Animated short film on "Diversification of livelihoods among women self-help group through brackishwater aquaculture technologies". Publication of CIBA No.04.

Technology Series

1. ShrimpSim-Shrimp Growth Simulation Model (Version 1.0). CIBA Technology Series 2026/25.

CIBA in Mass Media

மீன் வளர்ப்போர் தின விழா

புதுச்சேரி மீனவர் நலத்துறை மற்றும் மீன்வளர்ப்போர் மேம்பாட்டு முகமை சார்பில், தேசிய மீன் வளர்ப்போர் தின விழா பனையடிகுப்பத்தில் நடந்தது.

நெட்டப்பாக்கம், ஜூலை 12-

புதுச்சேரி மீன்வளம் மற்றும் மீனவர் நலத்துறை மற்றும் மீன்வளர்ப்போர் மேம்பாட்டு முகமை சார்பில், தேசிய மீன் வளர்ப்போர் தின விழா பனையடிகுப்பம் ஜே.கே. மீன் பண்ணையில் நடந்தது. நலத்துறை இயக்குனர் இஸ்மாயில் தலைமை தாங்கினார். துணை இயக் குனர்கள் கலியரசன், ஷாஜிமா முன்னிலை வகித் தனர். சிறப்பு அழைப்பள ராக சென்னை உவர் நீர் ஆராய்ச்சி நிறுவனத்தின் மூத்த விஞ்ஞானி சுப்பு ராஜ் பங்கேற்று கொடுவா மீன் வளர்ப்பு தொழில் நுட்பங்கள் குறித்து விளக்கினார். மீன் வ ள த் து ற அரசு செயலர் மணி கண்டன், காணொலி மூலம் மீன் வளர்ப்போர் தின வாழ்த்துக்களை தெரிவித்தார். நிகழ்ச்சியில், பாரதிதா சன் நன்னீர் மீன் விவசா யிகள் உற்பத்தியாளர் நிறு வனத்தை சேர்ந்த 50க்கும் மேற்பட்ட மீன் வளர்ப்

CIBA develops farming system for better shrimp yield

Chennai: The ICAR-Central Institute of Brackishwater Aquaculture (CIBA) has developed an indigenous 'super-intensive, precision and natural shrimp farming system' that can produce higher, disease-free yields at lower costs. The technology, which integrates proven methods to manage energy, water, feed, and land in shrimp farming, was recently transferred to industry.

CIBA scientist K P Kumaguru Vasagam said the indigenously engineered system brings together CIBA's technologies into a compact, circular rearing setup. It includes smart feeding, intelligent aeration, water recovery, in-situ natural feed production, minimal water exchange, and low energy consumption, making it climate-resilient and environmentally sustainable.

"We grew L. vannamei on the Pacific whiteleg shrimp using this system. In the future, it can be used for our own Indian shrimps," he said. Pilot units at CIBA's Muttukadu facility already demonstrated the model with 11 disease-free cycles of L. vannamei in the past two years, achieving survival rates of up to 97.8% and feed conversion ratios below 1.1. Farmers recorded yields of 40-50 tonnes per hectare per cycle compared with just six tonnes in conventional farms. With three to four cycles annually, production can exceed 120 tonnes per hectare annually.

"We are going for a very high-density with this system. Maintaining dissolved oxygen in the water is a critical factor. We need close monitoring of oxygen and backup for electricity to run the aeration systems, continuously. We are using smart aeration technology with at least three different types, paddle wheel blower, nano-air bubbles, and pure oxygen. These are some of the technologies we integrated into this to make it," Vasagam said.

According to the marine products export development authority (MPEDA), more than eight lakh metric tonnes of L. vannamei are farmed annually across nine states. Tamil Nadu and Puducherry together produced 84,750 tonnes during 2020-21. In 2023-24, India exported 1.38 lakh tonnes of frozen shrimp. Of this, L. vannamei alone contributed 8.22 lakh tonnes worth US$ 4,20,941 lion. Yet the sector continues to grapple with high input costs, climate variability, recurring diseases, and volatile prices. Conventional farms typically produce only five to six tonnes per hectare per cycle. "For the new system, the capital investment may be a little higher than the conventional farming system because it needs a highly engineered infrastructure. But the return on investment is in two to 2.5 years," Vasagam added.

PROGRESS: Aerial view of CIBA's new shrimp farming system

Super Intensive Shrimp Farming News (Times of India-English Newspaper, 29 September, 2025)

Vaccines being readied for aquaculture farms

TIMES NEWS NETWORK

Chennai: Fish grown in aquaculture farms in the country may soon receive vaccinations against diseases. Scientists are also working on oral vaccines to tackle infections.

Speaking on the sidelines of an event, J K Jena, deputy director general (fisheries science), Indian Council of Agricultural Research, said at least six injectable vaccines were developed and commercialised. Discussions are underway with the Central Drugs Standard Control Organisation (CDSCO) to establish guidelines. These vaccines are species and disease-specific, such as vaccines against Aeromonas infection in carp and Edwardsiella infection in other species.

"In another three to four months, the guidelines may be available, after which the vaccines can be commercially produced. Hopefully, in another year, all the important vaccines for key species will be available," he said. "Oral vaccines are still in development. There is a challenge in how to deliver them effectively in water or feed at a reasonable cost. We are working on both injection and feed-based approaches."

SAFEGUARDING FISH FARMS

The official was present at the inauguration of the 12th International Symposium on 'Diseases in Asian Aquaculture (DAA'12)' organized by ICAR-Central Institute of Brackishwater Aquaculture.

Globally, aquaculture contributes 59% or 223 million tonnes of fisheries production, and India is the second-largest producer. In India, aquaculture accounts for around 65% (18.5 million tonnes) of the country's fish production. Despite these advancements, the country loses about ₹50,000 crore annually due to aquatic diseases.

While bacterial, parasitic, and fungal diseases in aquaculture are manageable, viral infections such as White Spot Syndrome in shrimps remain a major challenge. "Shrimps cannot be vaccinated because they do not develop lasting immunity the way fish do due to biological limitations of crustaceans," he said.

He added that the best way to prevent viral diseases is to follow good management practices: avoid excess stocking density, ensure proper water quality (oxygen, pH, and ammonia levels), use disease-free seed, and maintain good feed and hygiene. Crop rotation, such as alternating shrimp-culture with fish such as mullet, milkfish, or seabass, can also reduce risks.

Earlier, George Kurian, Union minister of state for fisheries inaugurated the symposium. CIBA director

DAA Inauguration news (Times of India – English Newspaper, 24 September, 2025)

ICAR-CIBA successfully decodes genome of goldlined seabream

The Hindu Bureau
CHENNAI

A team of researchers from the Central Institute of Brackishwater Aquaculture (ICAR-CIBA), Chennai, has successfully sequenced the genome of the goldlined seabream (*Rhabdosargus sarba*), locally known as *matti vaayan* in Tamil. This species is one of the most preferred edible fishes in India and has high domestic market demand.

Being a euryhaline species, the goldlined seabream has strong potential for farming across a wide range of salinities and can be cultivated under various production systems, including ponds and cages. "It is distinguished by its characteristic golden stripes and is prized for its premium-quality white meat. It is considered a promising candidate for expanding India's aquaculture sector," a CIBA press release said.

Known as *matti vaayan* in Tamil, it is one of the most preferred edible fishes in India.

The availability of this high-quality, reference-level genome is a significant achievement that advances the overall understanding of the species.

Kuldeep K. Lal, Director of ICAR-CIBA, said the g... dlined seabream's ...quenced genome w... provide valuable ins... into its growth pote... reproductive biolog... metabolism. This r... is expected to sup... ture efforts in th... improvement a... ing of the specie...

The project ... M.S. Shekhar ... partment a... scientist.

The Hindu – English Newspaper, 22 July, 2025

d Culture

TUESDAY, SEPT...

Why our shrimp farmers need a better safety net

T Ravisankar & Kuldeep Kumar Lal

Generating about $8 billion annually and sustaining 1.2 million livelihoods, India's shrimp aquaculture anchors seafood exports. But global tariff price swings, climate tremors and recurring shrimp diseases leave smallholder farmers exposed to uncertainties. Cyclone Fengal's devastation in Tamil Nadu in 2024 exposed the fragility of the shrimp farming sector with thousands of farmers losing entire crops. While relief measures provide temporary relief, the real safeguard lies in crop insurance.

Shrimp crop insurance is not new. In the early 1990s, a wave of white-spot viral disease outbreaks triggered massive claims, overwhelming insurers and leading to the collapse of first-generation shrimp crop insurance products. In 2022-2023, two public sector insurers relaunched shrimp insurance with ICAR-Central Institute of Brackishwater Aquaculture's technical support. The cover now extends to white-leg shrimp (Penaeus vannamei) and black tiger prawn (Penaeus monodon) for about 130 days of culture, with a hybrid model of weather and graded periods of disease cover. The fisheries department backed the initiative, embedding it within flagship programmes implemented by the National Fisheries Development Board (NFDB) such as the Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana.

Yet the scheme faces hurdles. Premium pricing is based on limited datasets though disease and climate risks differ across states, districts and farm sizes. In Andhra Pradesh, diseases and temperature/ salinity fluctuations dominate; in Odisha, cyclones pose threats; in TN, vibriosis and EHP (Enterocytozoon hepatopenaei) are major concerns. A one-size-fits-all approach risks under-pricing some farmers and overburdening others.

Farmer distrust also remains high. Many cultivators fear that insurance is structured more for the company's sustainability than farmers' benefit. For shrimp farmers, delays in claim settlement can be disastrous as a single failed crop can erase an entire year's income. Without accredited assessors, claim resolution could be slow.

Linking policies with kisan credit cards or aquaculture loans would ease liquidity pressures and reduce reliance on informal lenders. At the same time, insurers must step up with flexible premium slabs, digitised claims and greater transparency in settlement.

The govt's role goes beyond incentive support. The fisheries digital portal must be farmer-friendly. Investing in additions such as voice-based data entry in local languages, automated claim dashboards and AI-enabled claim verification with geotagged inputs can reduce delays and build a mutual confidence between farmers and insurers. A dedicated national aquaculture insurance cell could help in mid-course corrections.

Policymakers must ensure especially socioeconomically weaker sections and women farmers are being meaningfully included. Transparent processes, farmer-centric design, and mid-course corrections are the pillars of credibility. For farmers, it makes the difference between sinking in debt or staying afloat for another season.

(The authors are senior researchers from ICAR-Central Institute of Brackishwater Aquaculture, Chennai)

HC quashes | Two die as bike

Times of India, 30 September, 2025

Television (TV) Programmes

SI No.	Name of the Scientist	Topics
1.	**Dr. R. Subburaj** Chief Tech. Officer	உவர் நீரில் பால் கெண்டை மீன் வளர்ப்பு | Milk Fish Culture in Brackishwater Aquaculture in Tamil Doordarshan (DD) Tamil – January, 2025
2.	**Shri R. Arvind** Scientist	சேற்று நண்டு வளர்ப்பு முறைகள்| Mud crab Farming and Poly culture in Tamil by, Doordarshan (DD) Tamil – January, 2025
3.	**Dr. C.V. Sairam** Principal Scientist	உவர்நீர் மீன் வளர்ப்பின் பொருளாதார நன்மைகள்| Economic Benefits of Brackishwater Aquaculture in Tamil Doordarshan (DD) Tamil – January, 2025
4.	**Dr. M. Kumaran** Principal Scientist	இறால் நாற்றாங்கால் வளர்ப்பு| in Tamil by Dr. M. Doordarshan (DD) Tamil – February, 2025
5.	**Dr. P. Mahalakshmi** Principal Scientist	மீன் கழிவிலிருந்து பெறப்படும் வளம்| in Tamil Doordarshan (DD) Tamil – February, 2025
6.	**Dr. M. Poornima**, Principal Scientist	இறால் வளர்ப்பில் முக்கியமான நோய்களை பற்றி கண்ணோட்டம்| in Tamil Doordarshan (DD) Tamil – March, 2025
7.	**Dr. K. P. Kumaraguru Vasagam** Principal Scientist	உவர்நீர் மீன்கள், இறால் மற்றும் நண்டுகளுக்கு தேவையான சரிவிகித சமச்சீர் உணவு| in Tamil Doordarshan (DD) Tamil – March, 2025
8.	**Dr. M. Kumaran** Principal Scientist	சீர்மிகு இறால் வளர்ப்பிற்கு CIBA மொபைல் செயலியின் பயன்பாடுகள்| in Tamil, Doordarshan (DD) Tamil – May, 2025
9.	**Dr. Debasis De** Principal Scientist, KRC of ICAR - CIBA	Live phone-in programme in Doordarshan Bangla on Fish Waste to Wealth and it's Use, Doordarshan (DD) Bangla – July, 2025
10.	**Dr.D. Deboral Vimala** Principal Scientist	நாற்றங்கால் கொடுவா மீன்குஞ்சு வளர்ப்பு | in Tamil in Doordarshan (DD) Tamil on 26 September, 2025

Radio Talks (AIR)

Sl. No.	Name of the Scientist	Topics
1	**Dr. M. Jayanthi**	Coastal resources and fish culture
2	**Dr. R. Saraswathy**	Water quality Management in shrimp culture
3	**Dr. M. Makesh**	Fish vaccines
4	**Dr. R. Jayakumar**	Seabass farming in brackishwater cages-An opportunity for income generation for fisherfolk
5	**Dr. T. Senthil Murugan**	Coastal ornamental aquaculture as livelihood option
6	**Dr. B. Sivamani**	Livelihood opportunities in pearlspot seed production and farming
7	**Dr. R. Subburaj**	Seed production of Asian seabass and farming in India
8	**Dr. K. Ambasankar**	ICAR-CIBA efforts in indigenous aqua feed technology Nutritional Significance of fish & shrimp
9	**Dr. T. Sivaramakrishnan**	Feeds and feed management in shrimp & fish culture
10	**Shri. K. Anantharaja**	Feeds and feed management in crab culture
11	**Dr. P. Ezhil Praveena**	Control measures to prevent viral diseases in Shrimp
12	**Dr. R. Ananda Raja**	Health Management in shrimp aquaculture in ulavar ulagam
13	**Dr. P. Kumararaja**	Soil quality Management in shrimp culture
14	**Dr. T. Bhuvaneswari**	Mitigation and prevention of antimicrobial resistance in aquaculture
15	**Dr. T. Sathish Kumar**	Tackling EHP in Shrimp Culture Scientific and practical Perspectives
16	**Dr. T. Ravisankar**	National fisheries digital portal
17	**Dr. C. V.Sairam**	Economic importance of brackishwater aquaculture farming in India
18	**Dr. D. Deboral Vimala**	Promotion of IMTA for income generation and optimum use of bio-resources
19	**Dr. M. Kumaran**	Shrimp Nursery Management
19	**Dr. P. Mahalakshmi**	Opportunities in brackishwater aquaculture technologies for livelihood development of Tribal & Scheduled Caste coastal fishers.

New year celebrations 2025

12th International Symposium on Diseases in Asian Aquaculture (DAA'12) on "Transformative Innovations Shaping the Future of Aquatic Animal Health Management," during 23–27 September 2025 in Chennai.

केंखा ज पा अ सं
CIBA
भाकृअनुप
ICAR

Headquarters

ICAR-Central Institute of Brackishwater Aquaculture

75, Santhome High Road,
MRC Nagar, RA Puram,
Chennai - 600 028, Tamil Nadu,
Telephone: +91 44 24616948,
24618817, 24610565, 24611062
Fax: +91 44 24610311
E-mail: director.ciba@icar.org.in

Research Centres

Kakdwip Research Centre of CIBA

Kakdwip, South 24 Parganas,
West Bengal - 743 347.
Telephone: +91 3210-255072
Fax: +91 3210-257030

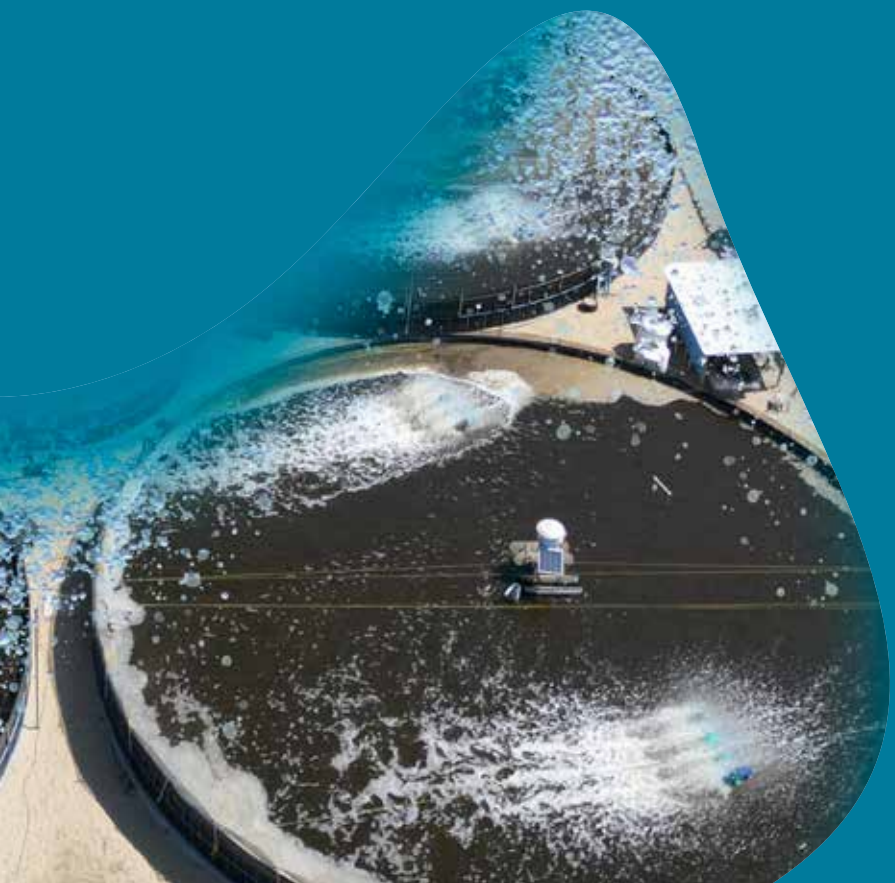
Navsari-Gujarat Research Centre of CIBA

1st Floor, Animal Husbandry
Polytechnic Building,
Navsari Agricultural University
Campus,
Eru Char Rasta, Dandi Road
Navsari - 396 450, Gujarat,
Telephone: +91 2637-283509

केंखाजपाअसं
CIBA

भाकृअनुप
ICAR

ICAR-Central Institute of Brackishwater Aquaculture
ISO 9001 : 2015
(Indian Council of Agricultural Research)
75, Santhome High Road, MRC Nagar, RA Puram,
Chennai - 600 028, Tamil Nadu,
Telephone: +91 44 24616948, 24618817, 24610565,
Fax: +91 44 24610311
E-mail: director.ciba@icar.org.in



Follow us on: / icarciba